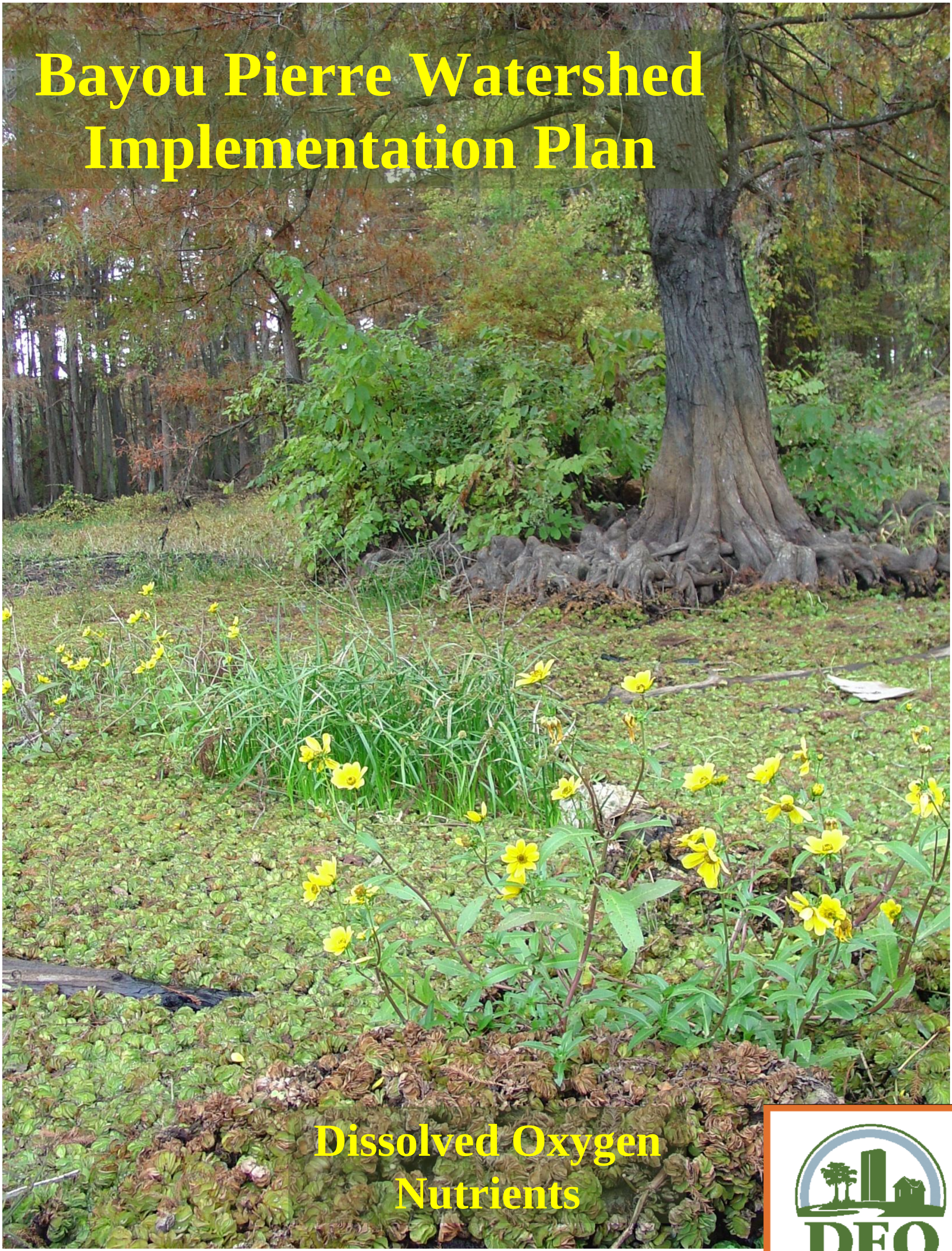
Bayou Pierre Watershed Implementation Plan



Dissolved Oxygen
Nutrients

DEQ
LOUISIANA

Cover photo: Bayou Pierre Lake, already infested with Salvinia.

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List of Abbreviations

BMP .... Best Management Practice
CWA...................... Clean Water Act
DO......................... Dissolved Oxygen
EPA........................ Environmental Protection Agency
FSA........................ Farm Security Administration
GPS .... Global Positioning Systems
LA.......................... Load Allocations
LCES .... Louisiana Cooperative Extension Service
LDAF .... Louisiana Department of Ag and Forestry
LDEQ...................Louisiana Department of Environmental Quality
LDNR.................... Louisiana Department of Natural Resources
MOS...................... Margin of Safety
NPS .... Nonpoint Source
NRCS.................... Natural Resources Conservation Service
SOD .... Sediment Oxygen Demand
SWCD................... Soil and Water Conservation District
TKN .... Total Kjeldahl Nitrogen
TMDL................... Total Maximum Daily Loads
UCBOD .... Ultimate Carbonaceous Biological Oxygen Demand
UNBOD................ Ultimate Nitrogenous Biological Oxygen Demand
USDA.................... United States Department of Agriculture
WLA...................... Waste Load Allocations

1.0 INTRODUCTION

Louisiana contains extensive areas of water bodies, including wetlands, bayous, rivers and lakes. Surface water in Louisiana is used for a wide variety of purposes such as drinking water, agricultural irrigation, transportation, industrial processes, recreation, seafood production, and wildlife habitat. A large percentage of the Louisiana economy and its cultural heritage are directly linked to the surface water resources that exist today.

Nonpoint source pollution is a diffuse source of water pollution that occurs when storm water flows across the land, transporting contaminants to a water body. Common land-use categories that contribute to nonpoint source pollution include agriculture, forestry, urban runoff, construction, home sewerage systems, resource extraction, and hydromodification. Detailed explanations of each category can be found in the State of Louisiana Water Quality Management Plan, Volume 6, Louisiana's Nonpoint Source Management, 2000.

The purpose of this report is to outline a plan which can be implemented to reduce the amount of nonpoint source pollution entering Bayou Pierre and thereby increase water quality to a level where the water body fully meets its designated uses.

Section 319 of the Clean Water Act (CWA) authorizes the Environmental Protection Agency (EPA) to issue grants to states to assist in implementing management programs to control nonpoint sources of water pollution. The 303(d) list of impaired water bodies consists of those water bodies that do not meet state regulatory water quality standards even with the current pollution controls in place and after point sources of pollution have installed the minimum levels of pollution controls.

The Bayou Pierre Watershed is on the 2006 303(d) list because it is not supporting its designated use of Fish and Wildlife Propagation. However it is fully supporting its designated uses of Primary Contact Recreation, Secondary Contact Recreation, and Agricultural Use. The Louisiana Department of Environmental Quality (LDEQ) has developed Total Maximum Daily Loads (TMDLs) for both nutrients and dissolved oxygen. TMDLs provide reduction goals for point and nonpoint source loading into the water body.

1.1 Ecoregion Description

The Bayou Pierre watershed is located in the South Central Plains ecoregion. The western part of the watershed is in the Tertiary Uplands, which is hilly and dissected by many small streams. The soil consists of well drained Eocene clays, silts, and sands. The eastern side is in the Red River Bottomlands. Native vegetation includes pine, oak, hickory, and sweetgum, although most of the pine-hardwood forest has been replaced by commercial pine plantations.

The eastern part of the Bayou Pierre watershed is located in the Red River Bottomlands, which is the floodplain of the Red River. The soil is well to somewhat poorly drained Holocene alluvium. Native vegetation includes oaks, sweetgum, locusts, river birch, and red maple. Most of the hardwood forests have been replaced by cropland and pastureland, with some forests remaining in poorly drained soil that is unsuitable for agriculture.

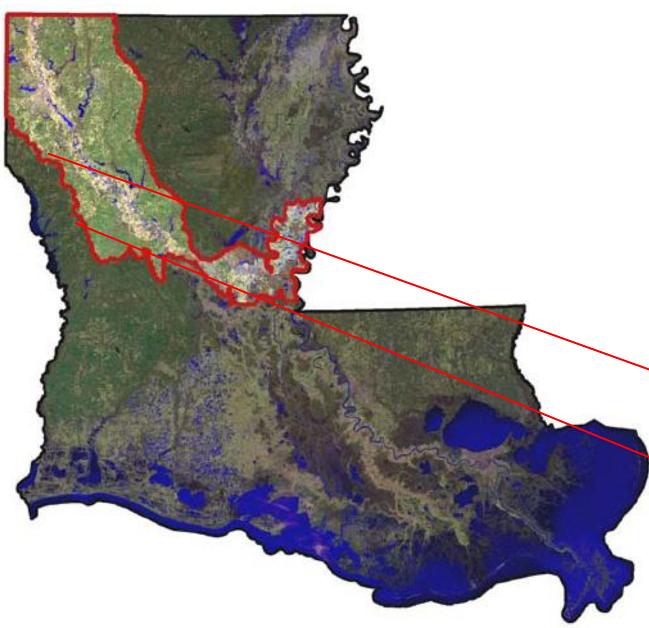
1.2 Red River Basin Description

The Bayou Pierre Watershed is located along the western edge of the Red River Basin. The Red River flows through New Mexico, Oklahoma, Texas, and Arkansas before entering Louisiana. From the northwest corner of the state, the Red River flows about 160 miles southeast to reach the Atchafalaya River (LDEQ, 1996). The Red River Basin covers an area over 4.9 million acres.

More than a third of the Red River Basin is classified as either deciduous or evergreen forestland. Agriculture is the second largest land use in the basin, over half of which is pastureland (LDEQ, 2006).

Table 1. Red River Basin Land Use

Land Use	Acres	Percent
Forestland	3,359,251	68.25%
Agriculture	1,067,990	21.70%
Urban	296,974	6.03%
Water	179,821	3.65%
Mining	9,256	0.19%
Unclassified	7,926	0.16%
Wetland	979	0.02%
Total	**4,922,197**	**100%**



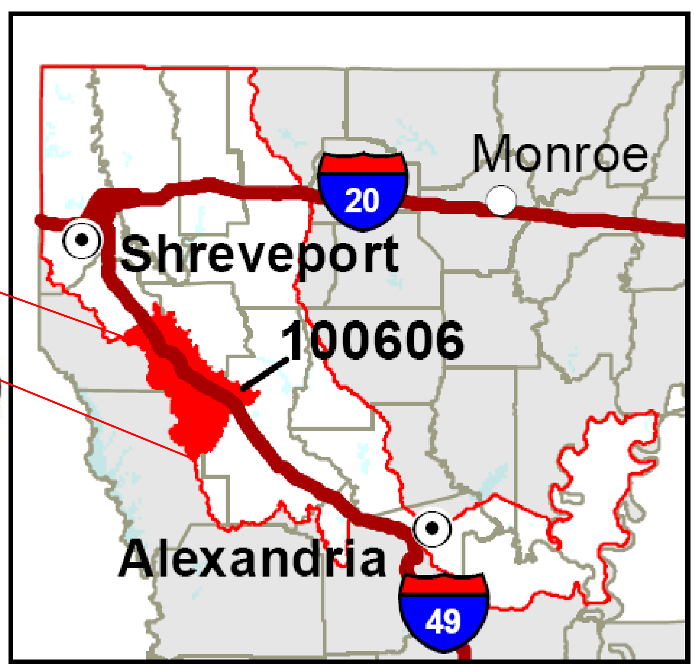


Figure 1. Map of the Red River Basin and Bayou Pierre Watershed 100606.

2.0 WATERSHED LAND USE

Almost half of the land use in the Bayou Pierre Watershed is evergreen forest and about a third is agricultural land which is primarily pastureland. Interstate 49 runs along the length of the watershed, almost bisecting it in half. The western side of I-49 is mainly forestland and to the east is mostly pastureland. In the northern part of the sub-segment, Bayou Pierre is bordered on the west by forestland and on the east by pastureland and corn fields. South of Hwy 177, Bayou Pierre is primarily surrounded by pastureland. In the southern half of the watershed, south of Hwy 174, the vegetated buffer zone along the bayou becomes very sparse. In some places the agricultural land extends right up to the bank of the bayou.

There are no large urban areas within the watershed. Rural residences and businesses are scattered throughout the area and not concentrated along the bank of the bayou. Most of the developed areas are to the west of I-49, on the side opposite from Bayou Pierre. The two largest populated areas within the watershed are Robeline and Powhatan. According to the 2000 Census, the population of the Town of Robeline was 183 and the Village of Powhatan was 141.

Table 2. Bayou Pierre Watershed Land Use

Agricultural Land Use	Acres	Percent
Pasture	88,064.5	26.4%
Cotton	7,592	2.3%
Soybeans	6,048	1.8%
Rice	1,038.5	0.3%
Corn	947	0.3%
Aquaculture	876	0.3%
Orchard	127	0.04%
Subtotal	**104,693**	**31.4%**
Non-agricultural Land Use	**Acres**	**Percent**
Evergreen Forest	156,322.5	46.8%
Deciduous Forest	57,735	17.3%
Developed/Urban	6,177	1.9%
Water	4,911.5	1.5%
Gravel Pit	1,692	0.5%
Oil/Gas	233	0.07%
Transitional	131	0.04%
Floating Aquatics	131	0.04%
Sand	57	0.02%
Wetland	42	0.01%
Clouds (unclassified)	1,957	0.59%
Total	**334,082**	**100%**

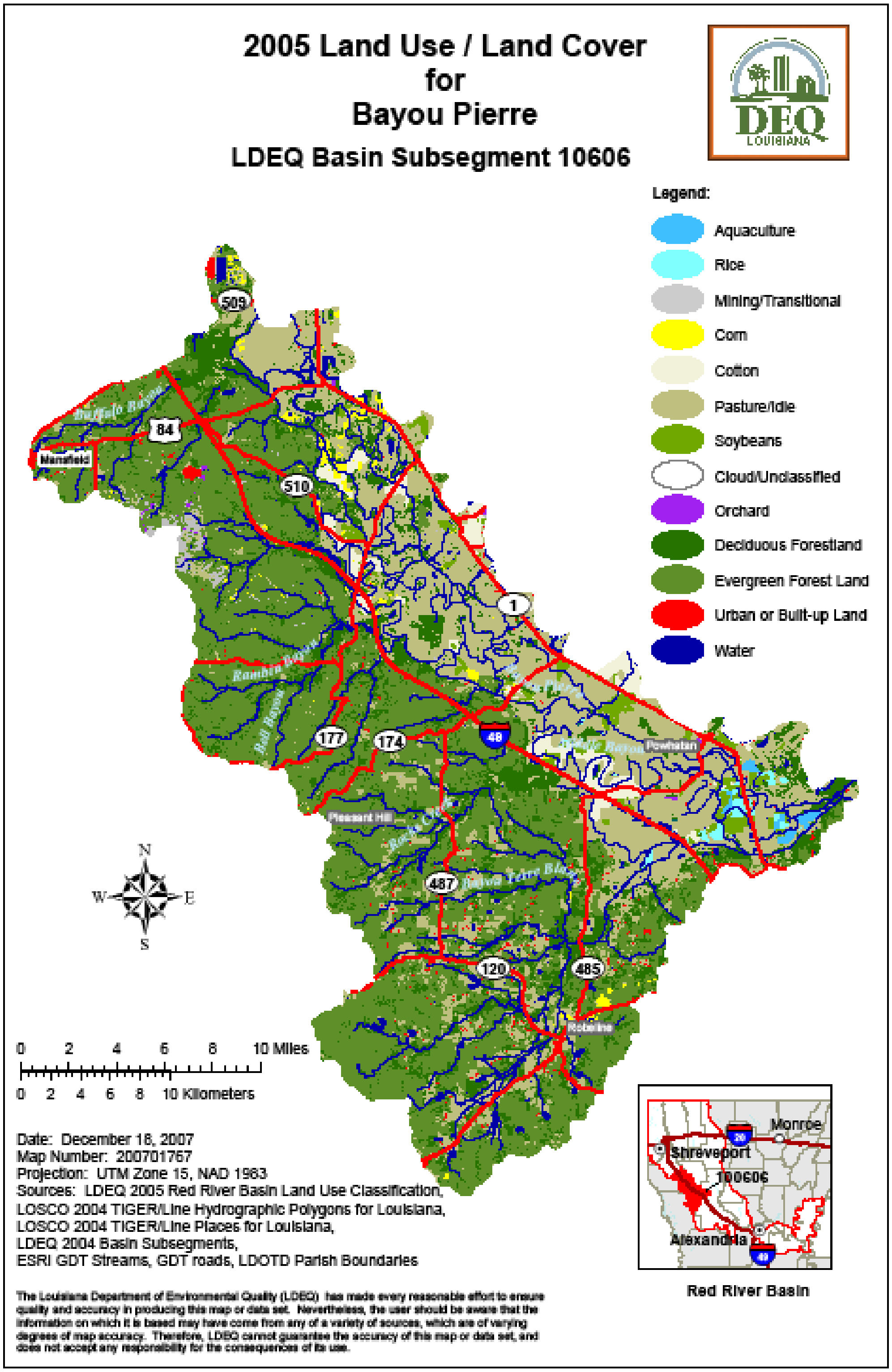


Figure 2. Land Use Map of the Bayou Pierre Watershed.

2.1 Bayou Pierre Watershed Description

Bayou Pierre is divided into two watersheds. The northern watershed is sub-segment 100601, which begins in Shreveport and ends where Rolling Lake Bayou enters Bayou Pierre. Sub-segment 100601 is impaired by fecal coliform caused by failing septic systems and other unknown sources. It is also impaired by low dissolved oxygen by unknown sources.

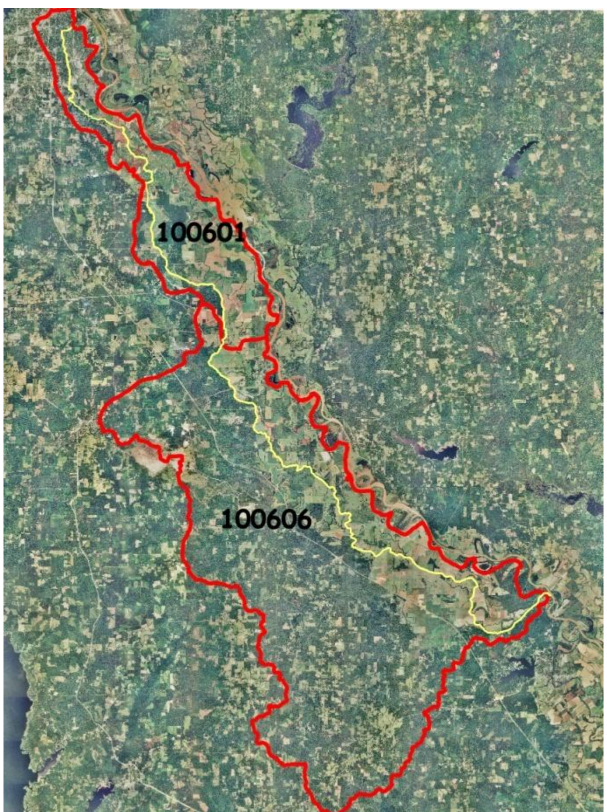


Figure 3. Map of the upper (100601) and lower (100606) Bayou Pierre Watersheds.

The southern watershed is sub-segment 100606, on which this report is focused. This lower part of Bayou Pierre does not have a problem with fecal coliform. Bayou Pierre is listed as impaired for nitrates/nitrites, phosphorus, and dissolved oxygen.

The size of the lower Bayou Pierre Watershed is approximately 7,691 square miles. The portion of Bayou Pierre that is modeled in the TMDL report is 80.2 kilometers long from just below Bayou Pierre Lake to its confluence with the Red River. The northeastern border of the Bayou Pierre watershed runs along the Red River. The western border of the watershed is bordered by the Toledo Bend Reservoir watershed.

There are more than 80 tributaries flowing into Bayou Pierre. Tributaries include Shell Bayou, Johnson Chute, Rolling Lake Bayou, Three League Bayou, Grand Bayou, Bailey Bayou, Butler Slough, Swift Bayou, Chicot Island Tributary, Garsia Bayou, Flat River, Bull Bayou, Pig Pen Bayou, Boggy Bayou, Bayou Lumbra, St. Mary Bayou, Bayou Winsey, Coon Slough, Jims River, Wright Bayou, Horseshoe Bayou, Squirrel Bayou, Bayou Pierre Lake, Red Bayou, Maguire Branch, Hickman Bayou, and Mundy Bayou. There are also 65 unnamed tributaries. The flow from the tributaries is influenced by irrigation in the agricultural land located in the watershed, as well as the amount of rainfall. The low water sill located along Bayou Pierre holds water for irrigation and livestock during extreme low flow conditions.

There are six known pumps located on the mainstem of Bayou Pierre. These pumps are used for farming practices in the area. When in use, the pumps can have a significant impact on the flow of Bayou Pierre. Because these pumps are operated intermittently, it is very difficult to quantify their impact.

There are seven permitted dischargers located in this watershed. All of the dischargers located on this water body are small and are unlikely to have an impact on Bayou Pierre due to their small loads and/or their distance from the bayou.

The Bayou Pierre Watershed Sub-segment 100606 begins at the northern edge of Bayou Pierre Lake. The bayou passes by the eastern edge of this lake and there is some water exchange between the bayou and lake. At the bottom of the watershed, Bayou Pierre drains into the Red River. Periodically, the lock and dam system in the Red River can slow down the water that is exiting Bayou Pierre.

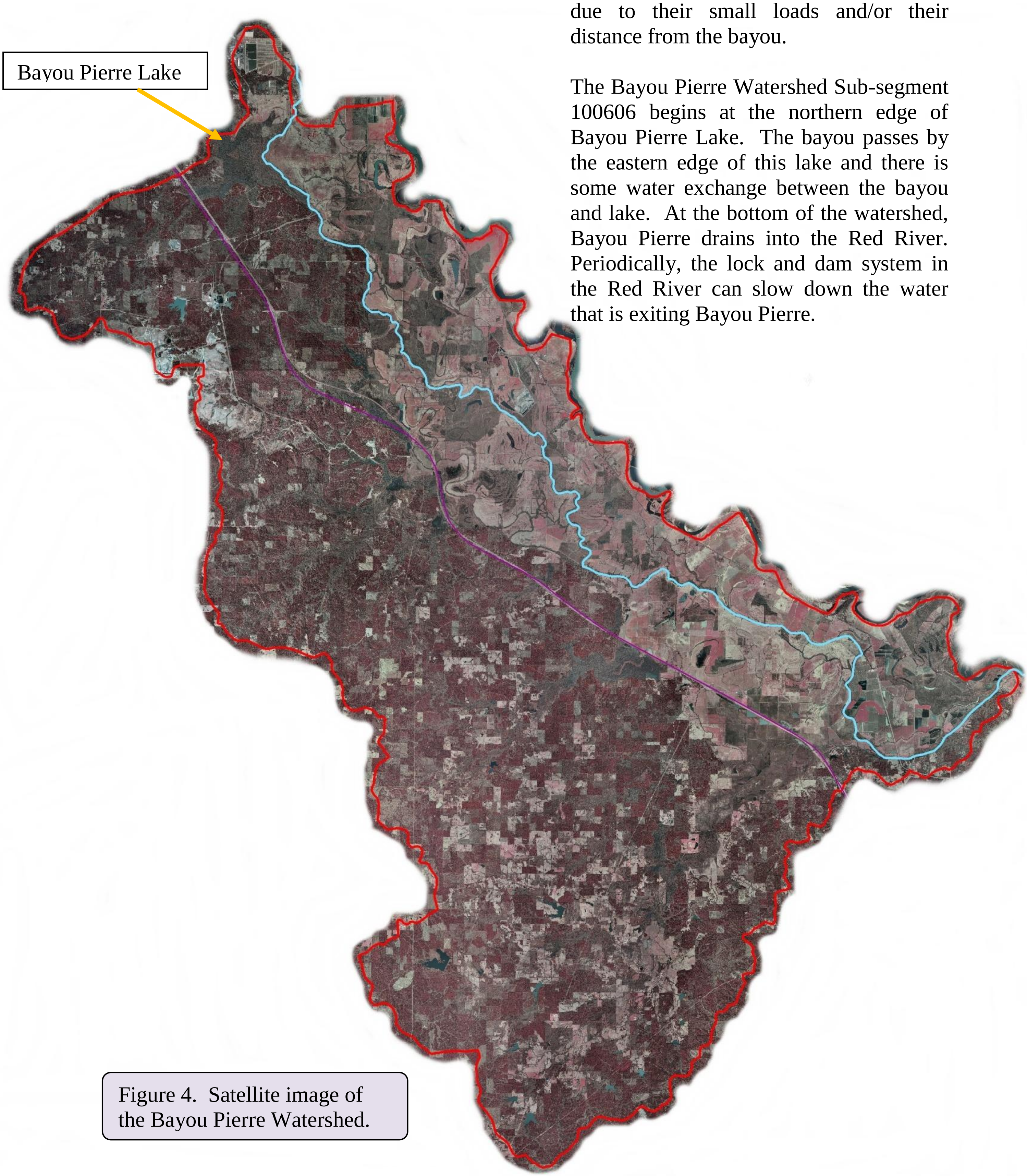


Figure 4. Satellite image of the Bayou Pierre Watershed.

Water from Smithport Lake enters Bayou Pierre Lake via a water control structure. A dam separates the two lakes, but during periods of very high water, the dam is easily overcome. Since Smithport Lake is engulfed with salvinia, Bayou Pierre Lake already contains salvinia, and there is a high risk that eventually Bayou Pierre will also become choked by salvinia. Further controls are needed to prevent the spread of salvinia into the watersheds downstream of Smithport Lake.

Figure 5. Bayou Pierre Lake (upper left photo), salvinia and debris entering into the lake from Smithport Lake (upper right) and the water control structure between the lakes (bottom).

Figure 6. The water control structure between Bayou Pierre Lake (on the right side of the levee) and Smithport Lake during low and high water.

The two photographs in Figure 6 illustrate the change in Smithport Lake and Bayou Pierre Lake during periods of low water and high water. The top photo is from the fall of 2008, while the lower photo is from winter of 2005. Salvinia has taken over most of the lake surface area in Smithport Lake and is moving into Bayou Pierre Lake.

Figure 7. This was pastureland, but is now part of the Wetland Reserve Program.

Much of the conservation and agricultural data from other agencies is organized by parish instead of by the watershed. This makes it difficult to get a clear picture of what is being implemented in any particular watershed. The Bayou Pierre watershed is part of four parishes: Natchitoches, Red River, Sabine, and DeSoto.

Table 3. Change in number and size of farms.

Parish	Number of Farms in 2007	% change since 2002	Average Farm Size in 2007	% change since 2002
Natchitoches	571	+1	388 acres	+14
Red River	251	+6	412 acres	-30
Sabine	366	-9	138 acres	-11
DeSoto	619	-1	270 acres	+24
Source: www.agcensus.usda.gov				

Table 4. Acres of Conservation Programs Applied During 2008 FY per Parish

Program	Natchitoches	Red River	Sabine	DeSoto
Total Applied Conservation Systems	15,211	5,692	4,210	3,451
Environmental Quality Incentive Program	7,628	2,713	1,569	2,425
Wildlife Habitat Incentives Program	152	7	68	299
Conservation Reserve Program	3,261	661	0	0
Wetlands Reserve Program	294	0	0	0
Source: http://ias.sc.egov.usda.gov/prsreport2008/report.aspx?report_id=102				

3.0 WATER QUALITY ANALYSIS

LDEQ maintained three sampling locations on Bayou Pierre during different time periods as part of the Statewide Water Quality Monitoring Network. From 1987 through 1989, monthly data was collected at site 0143, which was located near the middle of the watershed at Lake End. From 1990 to mid-1998, data was collected once every two months at site 0277, located at the top of the watershed west of Grand Bayou. Monthly data was collected in 2002, 2004, and from October 2007 through August 2008 from site 1185, which is located at the bottom of the watershed at Highway 1. The sampling data from these sites are presented in graphs in Section 3.1.

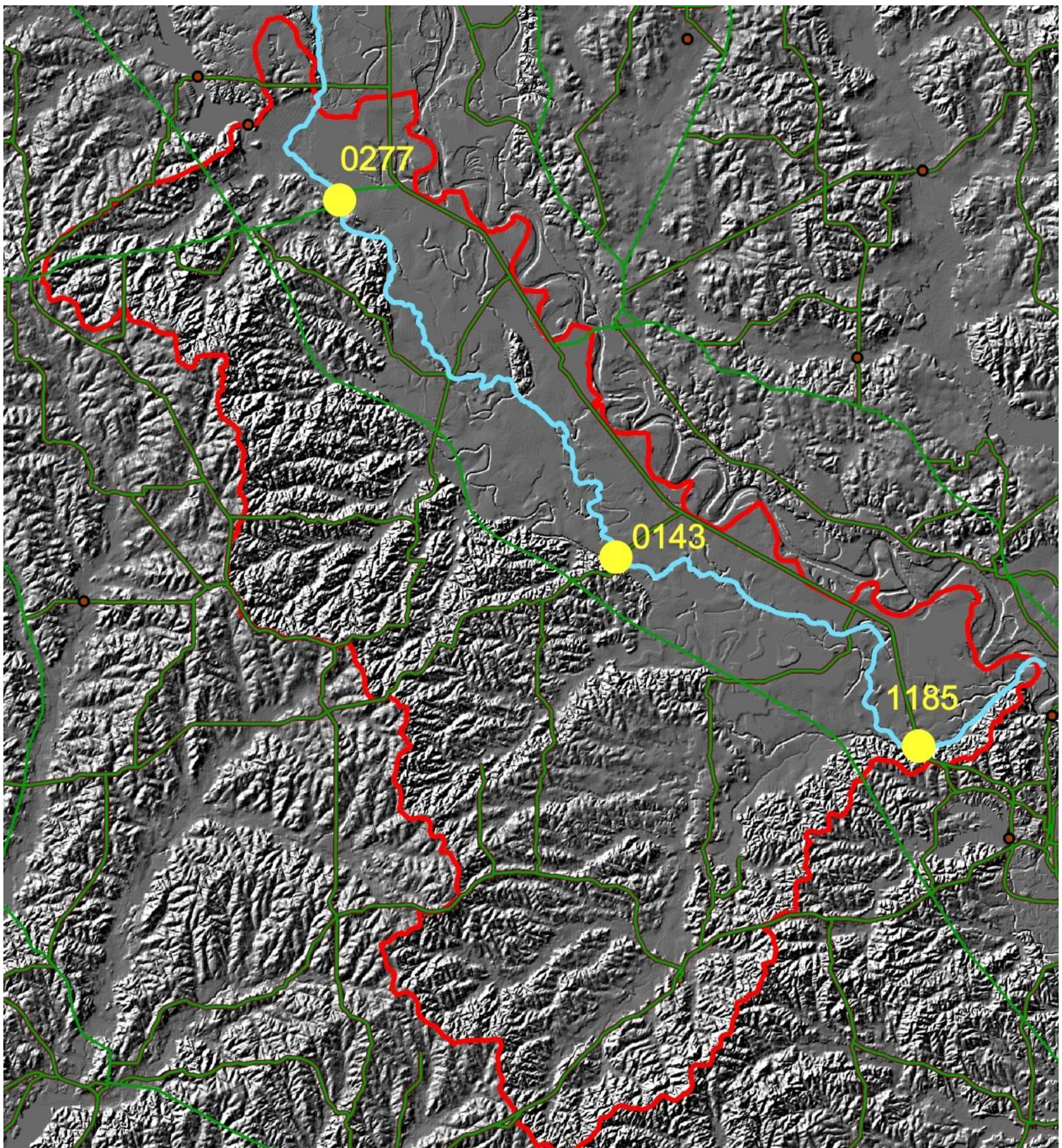


Figure 8. Elevation map showing the three water quality sampling locations.

It is important to keep in mind while looking at the graphs that the three sets of data were collected during three different time frames and at three different locations. The locations of the sampling sites should be considered when comparing data to see if it appears to be improving. A sample collected from the bottom of the watershed may naturally have more pollutants than a sample collected from the top of the watershed at any given time. Also, agricultural activities such as fertilizing, irrigating, and tilling occur during certain times of the year, which can cause seasonal deterioration of the water quality

A water quality standard is a definite numerical criterion value or general criterion statement to enhance or maintain water quality and to provide for, and fully protect, the designated uses of a water body (LDEQ, 2003). The water quality standards for Bayou Pierre are listed in Table 5.

Table 5. Water Quality Standards

Water Quality Parameter	Numerical Criteria
Chlorides	150 mg/L
Sulfates	75 mg/L
Dissolved Oxygen	5.0 mg/L
pH	6.0 - 8.5
Bacteria concentration (log mean/100 ml)*	200 for May 1 - Oct. 31 1,000 for Nov. 1 - April 30
Temperature	32^{o}C
Turbidity	50 NTU

* 200 colonies/100mL maximum log mean and no more than 25% of samples exceeding 400 colonies/100mL for the period May through October; 1,000 colonies/100mL maximum log mean and no more than 25% of samples exceeding 2,000 colonies/100mL for the period November through April.

3.1. Water Quality Test Results

Figures 9-11 show the water quality data for nitrogen and phosphorus at each site. There are currently no numerical criteria established for nutrients. Title 33 of the Environmental Regulatory Code states that the naturally occurring ratio of nitrogen and phosphorus shall be maintained, and nutrients should not be so abundant that they cause aquatic vegetation to interfere with the water bodies designated uses. LDEQ is in the process of developing numerical criteria for nitrogen and phosphorus. These criteria will be based on water body type and ecoregions of the state. Figures 12 and 13 show the water quality data for TKN and Phosphorus for all of the sites combined. This allows the data from the three sites to be compared to see if there is any trend over the past two decades.

Figures 14-16 show the water quality data for fecal coliform at each site. The fecal coliform concentrations exceeded the criteria 8 times during the 1980's at site 0143, 10 times during the 1990's at site 0277, and only 3 times during the 2000's at site 1185. Figure 17 shows the fecal coliform data for all the sites. Even though the data was taken from different locations, the level of fecal coliform seems to have improved in the 2000's compared to the 1980's.

Figures 18-20 show how Dissolved Oxygen and Water Temperature have an inverse relationship at each site. Figure 21 shows that there has been no improvement in the level of DO since it continues to fall below 5mg/L during the summer months when the water temperature increases. The Dissolved Oxygen levels fell below the criteria 4 times during the 1980's at site 0143, 12 times during the 1990's at site 0277, and 12 times during the 2000's at site 1185.

Figures 22-24 show the water quality data for turbidity at each site. The turbidity measurements exceeded the criteria 11 times during the 1980's at site 0143, 8 times during the 1990's at site 0277, and 6 times during the 2000's at site 1185. There appears to be a trend of decreasing turbidity over the past two decades, which could be attributed to land adjacent to the bayou being entered into conservation programs.

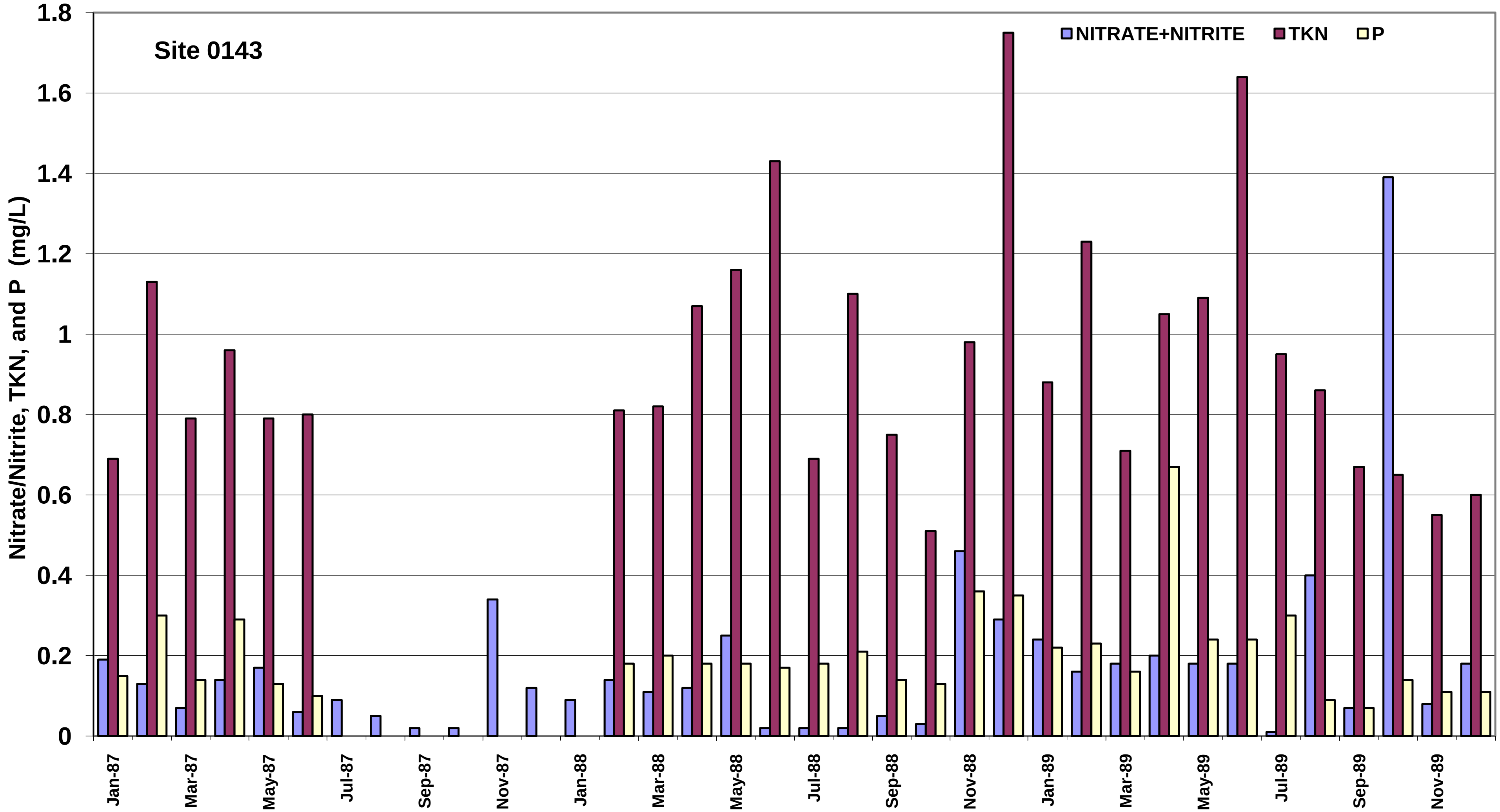


Figure 9. Water quality data of Nitrate/nitrite, TKN, and Phosphorus for site 0143.

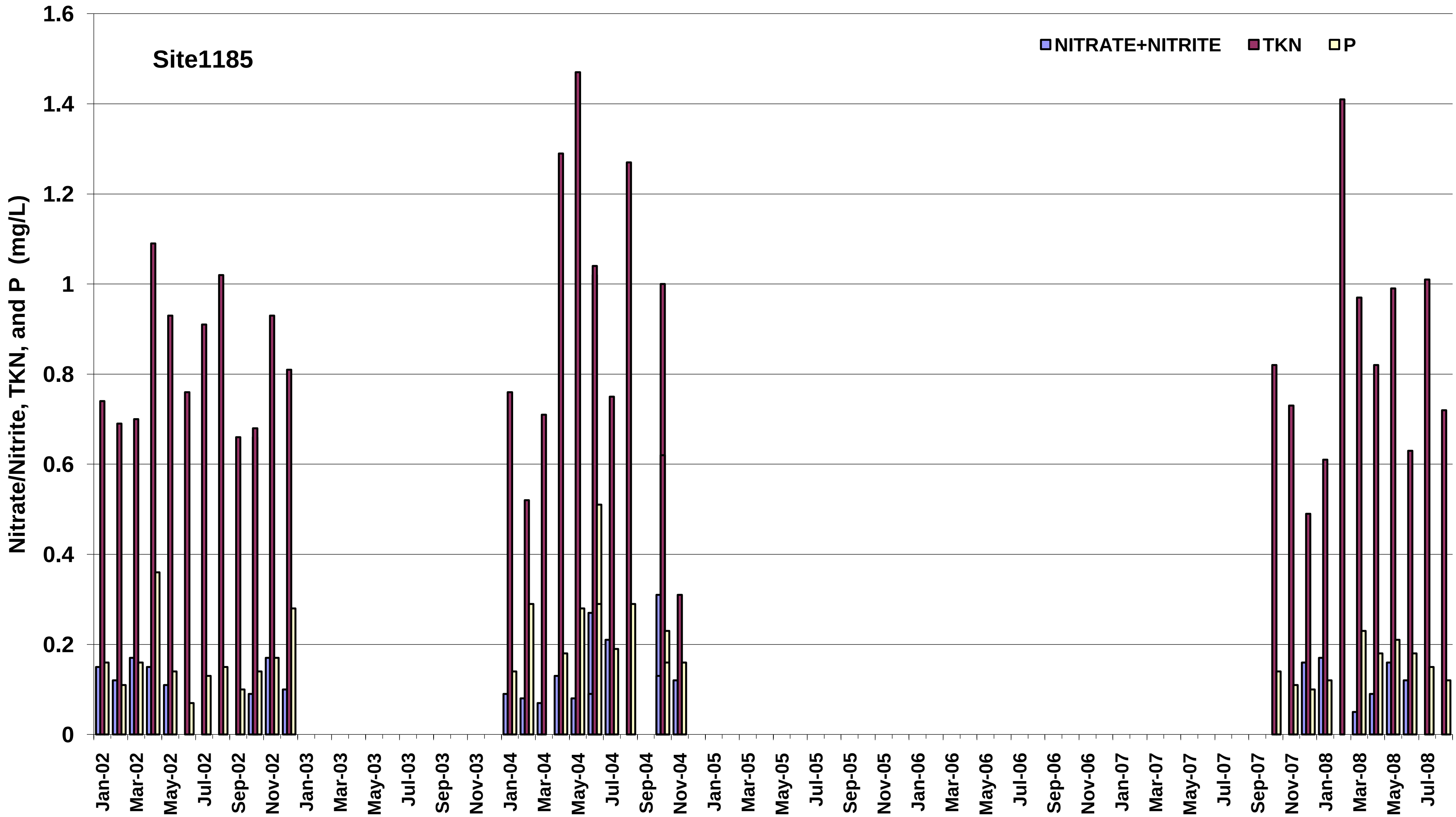


Figure 10. Water quality data of Nitrate/nitrite, TKN, and Phosphorus for site 1185.

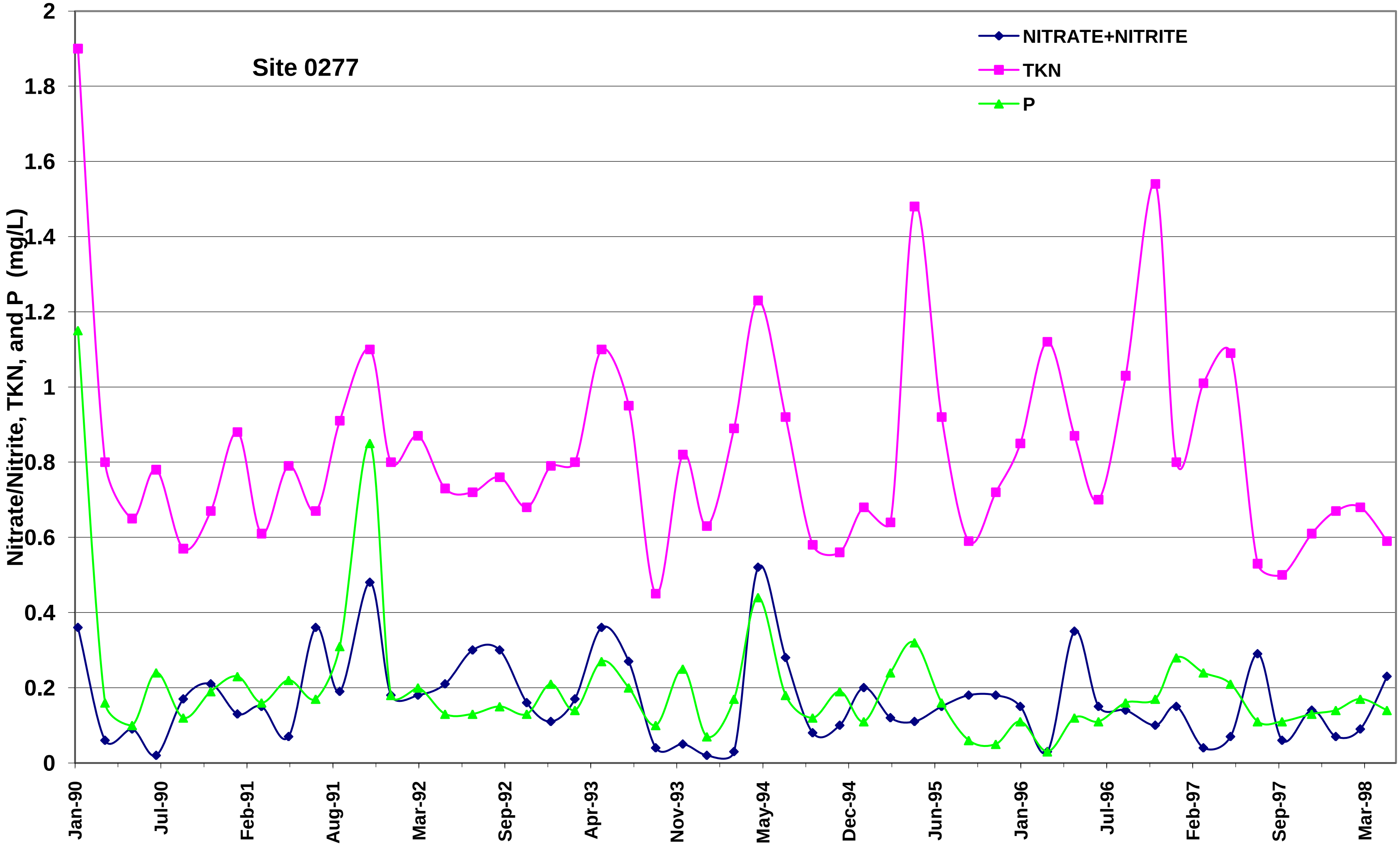


Figure 11. Water quality data of Nitrate/nitrite, TKN, and Phosphorus for site 0277.

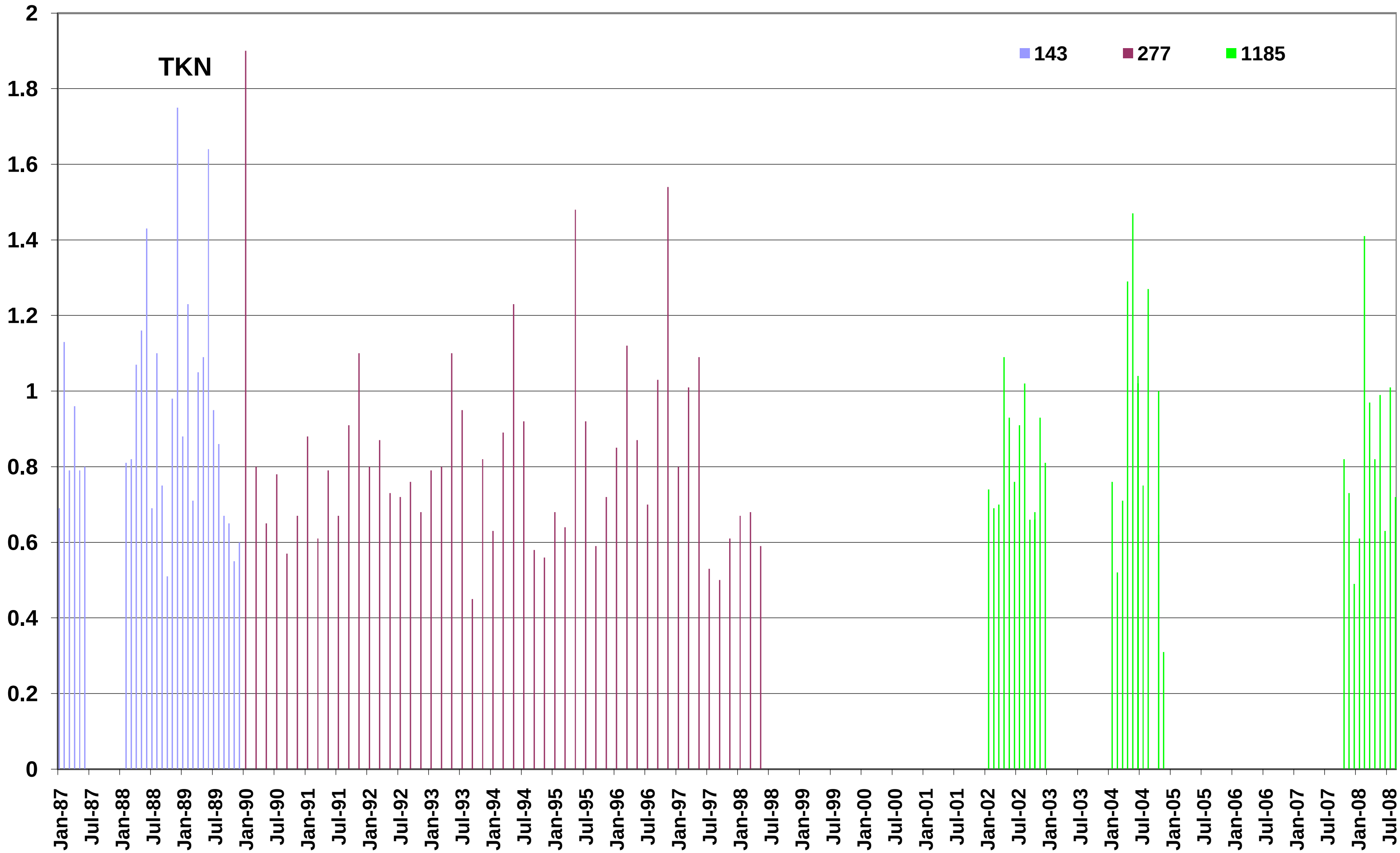


Figure 12. TKN water quality data for all the sites.

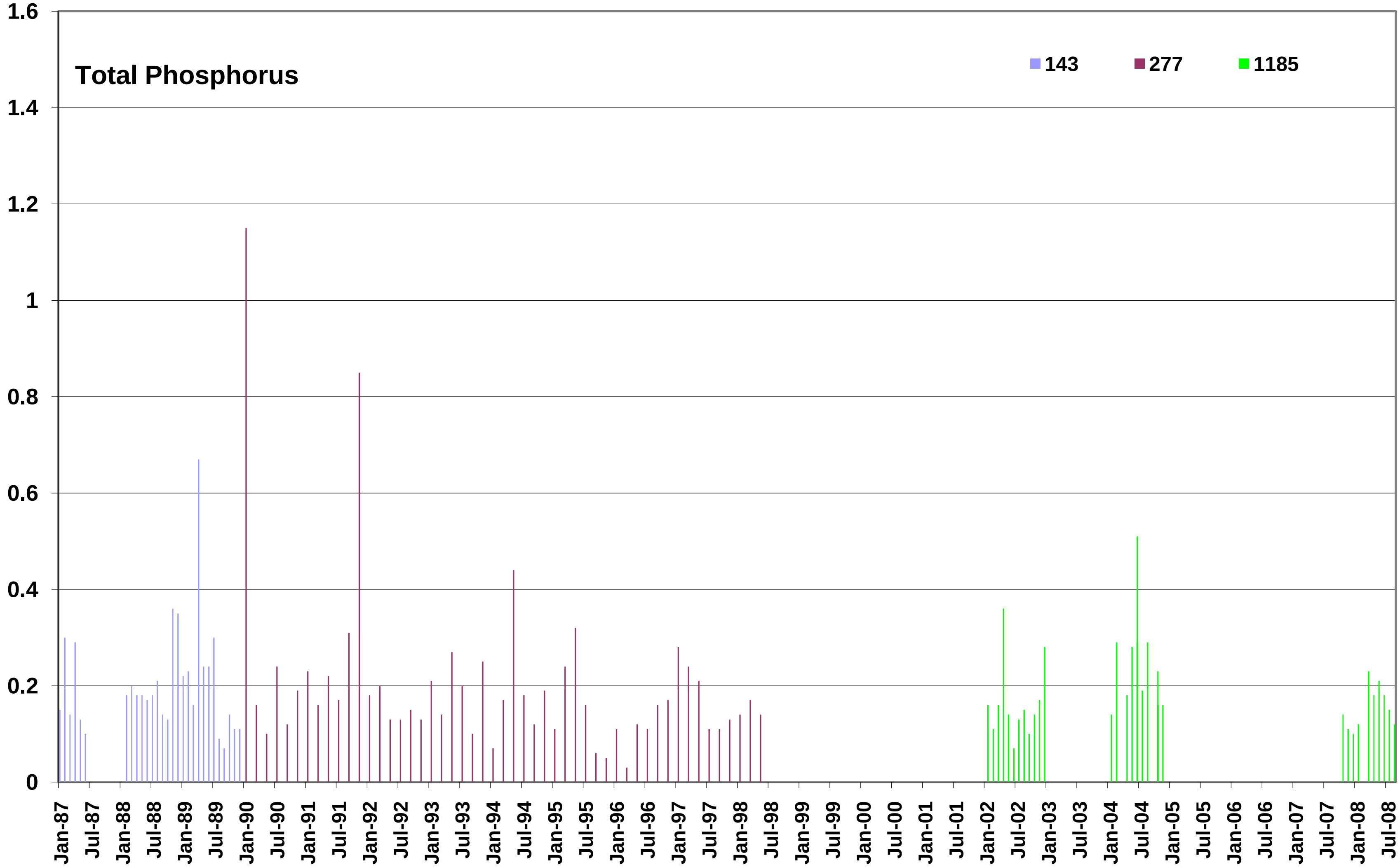


Figure 13. Phosphorus water quality data for all the sites.

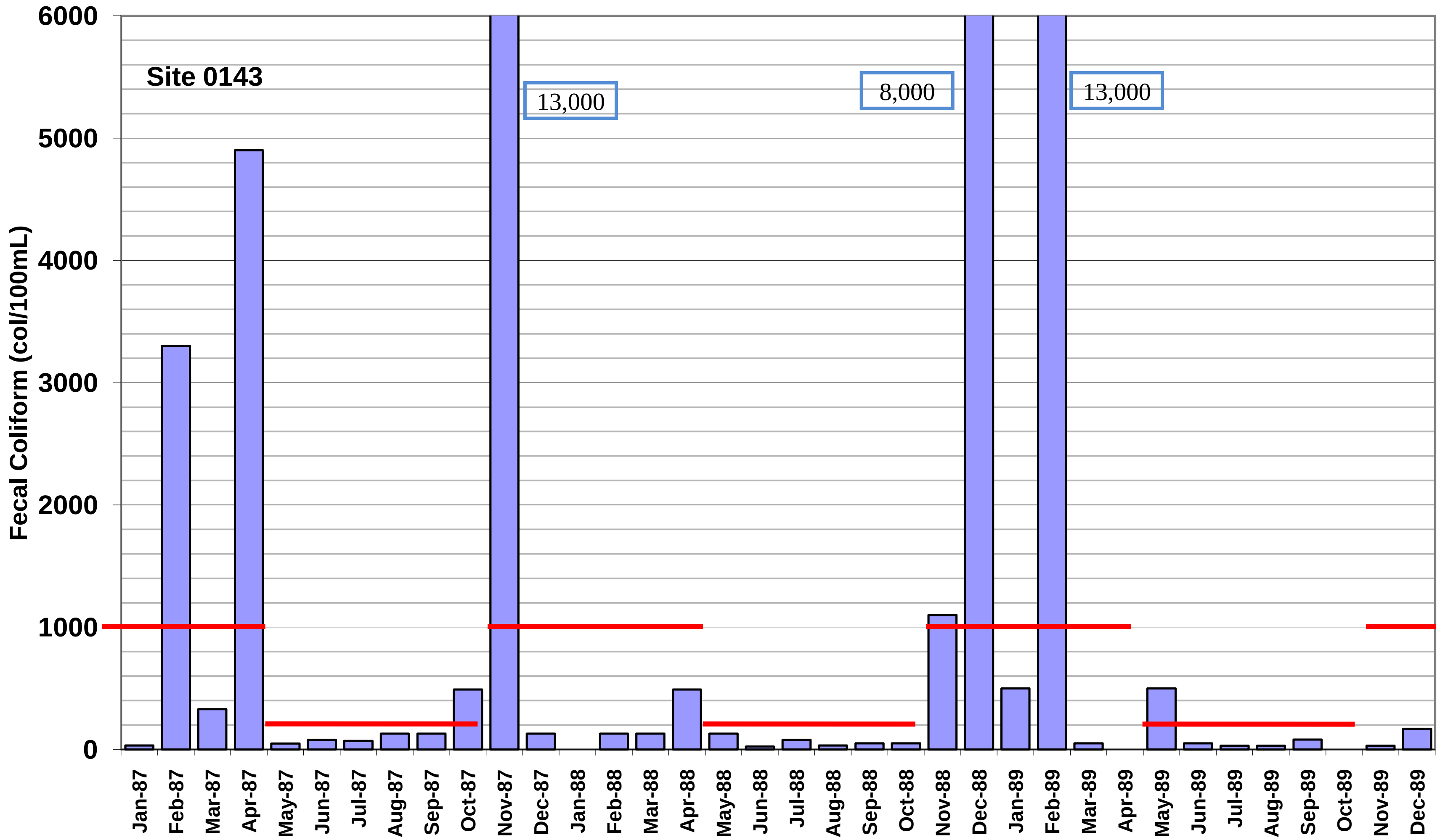


Figure 14. Fecal coliform water quality data for site 0143. Red line marks the maximum fecal coliform criteria during the winter (1000) and summer (200).

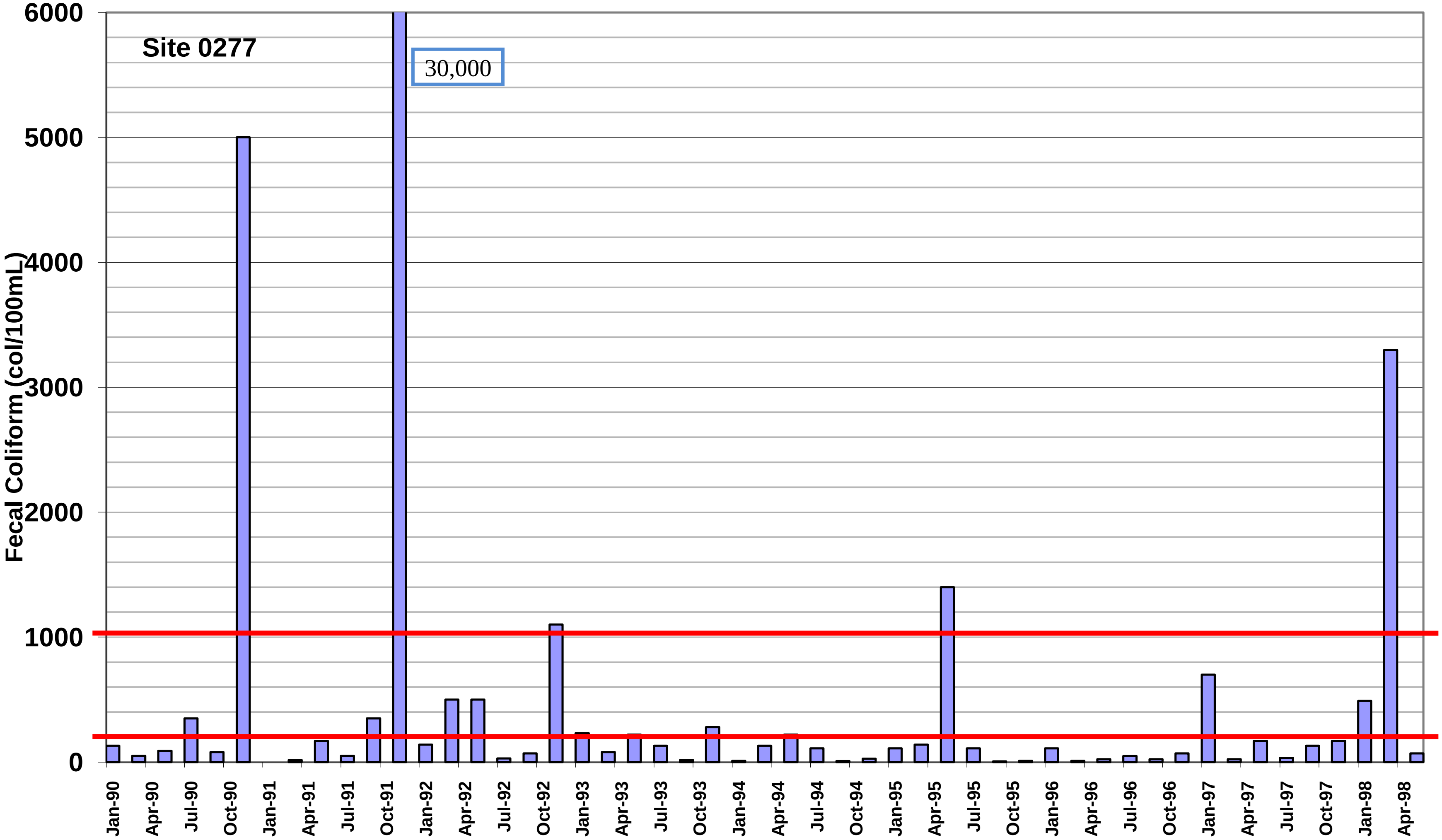


Figure 15. Fecal coliform water quality data for site 0277. Red line marks the maximum fecal coliform criteria during the winter (1000) and summer (200).

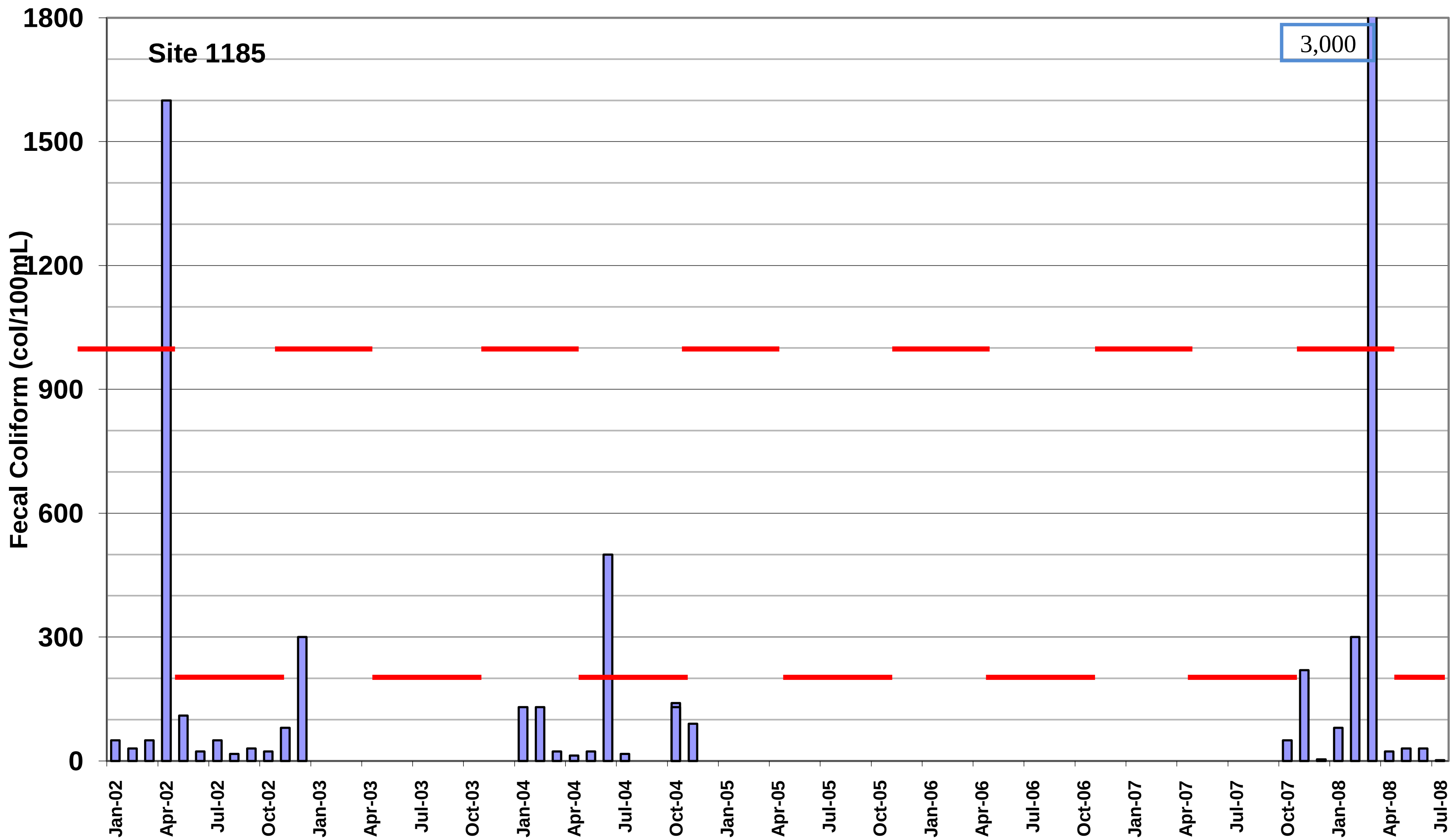


Figure 16. Fecal coliform water quality data for site 1185. Red line marks the maximum fecal coliform criteria during the winter (1000) and summer (200).

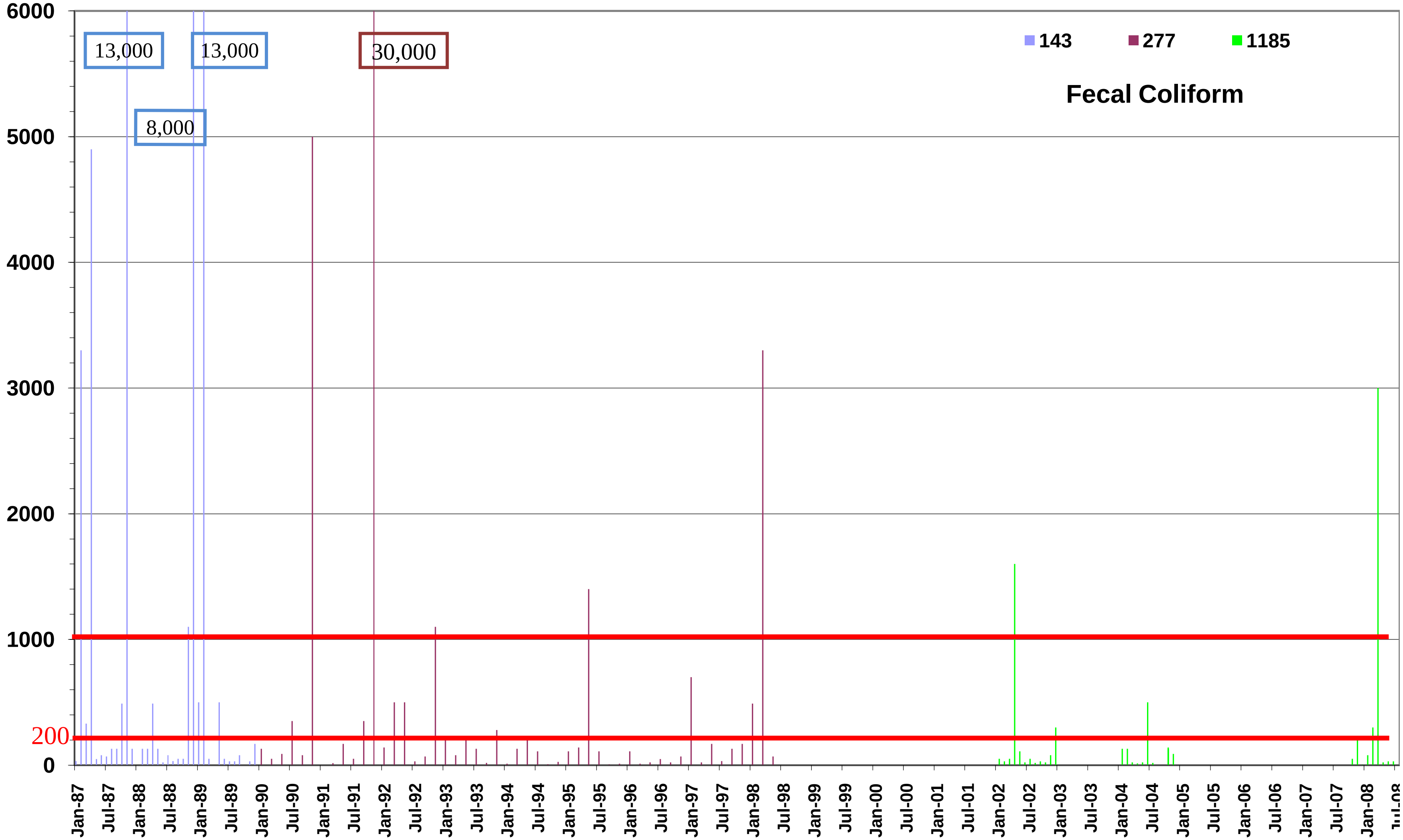


Figure 17 Fecal coliform water quality data for all the sites. Red line marks the maximum fecal coliform criteria during the winter (1000) and summer (200).

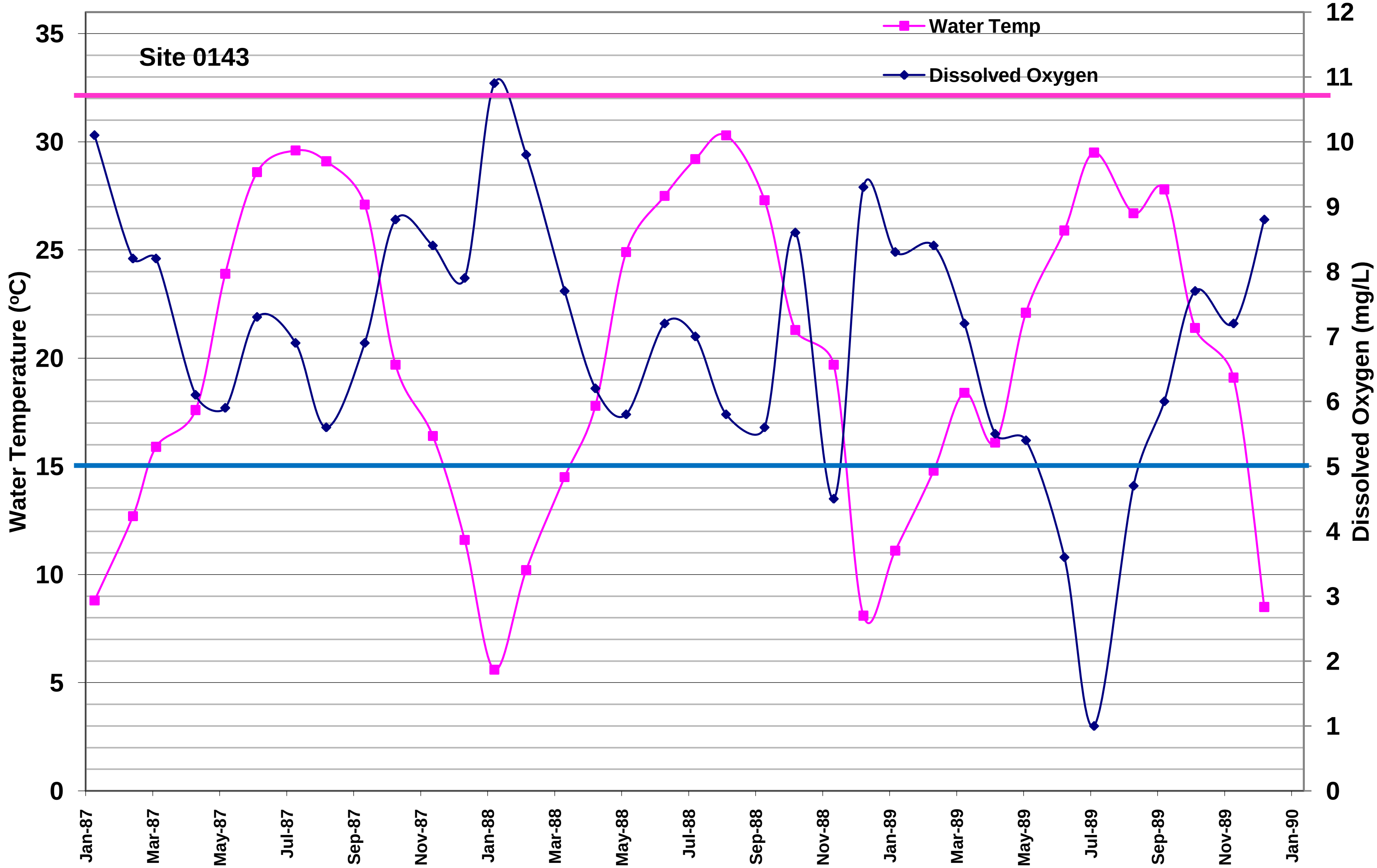


Figure 18. Water temperature and DO data for site 0143. Blue line marks the minimum DO criteria, red line marks the maximum water temperature criteria.

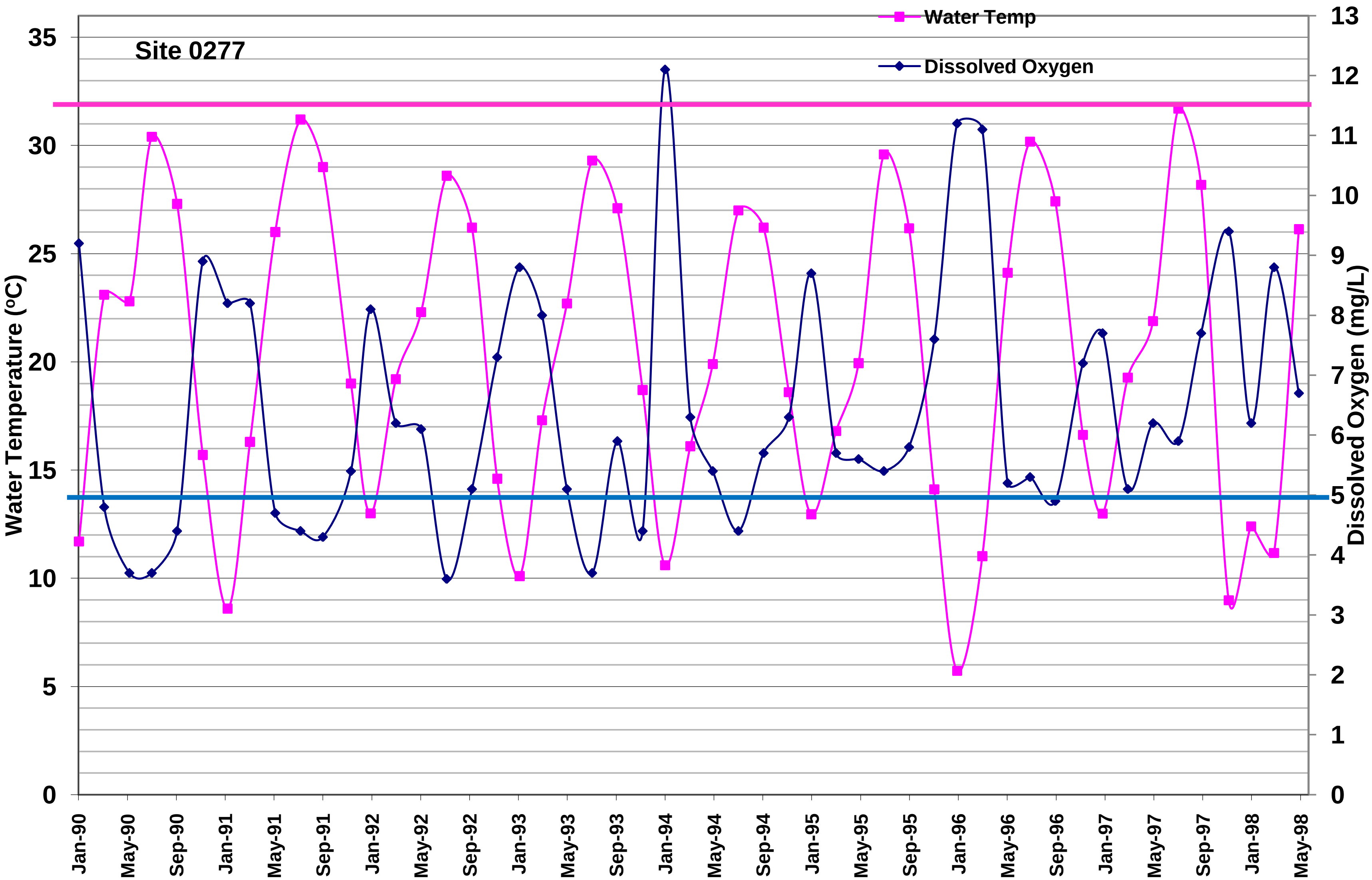
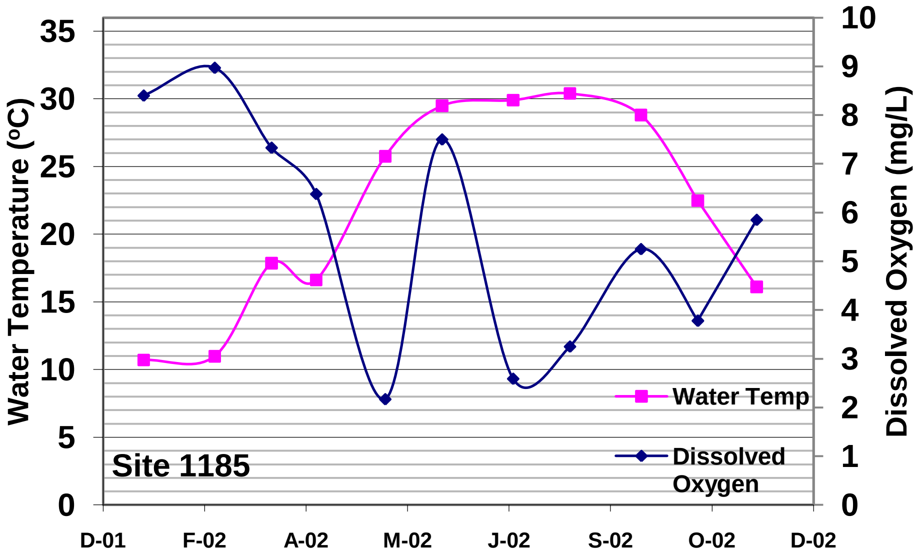
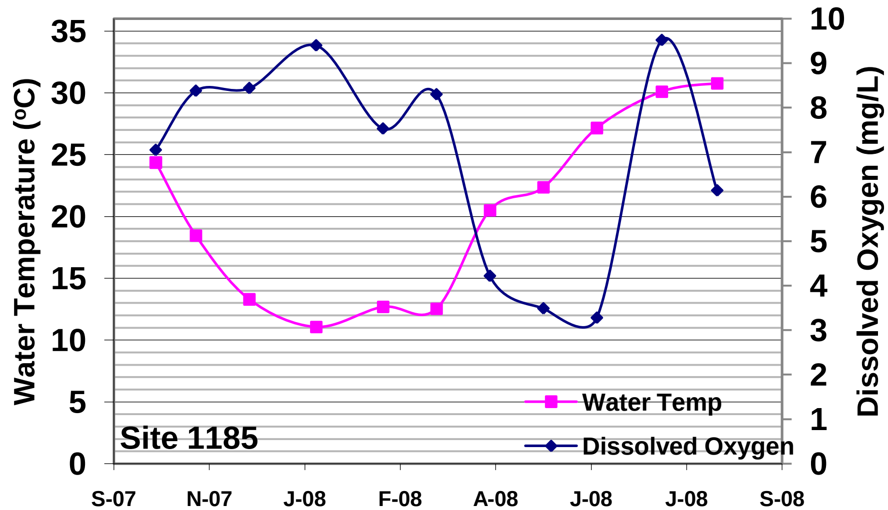


Figure 19. Water temperature and DO data for site 0277. Blue line marks the minimum DO criteria, red line marks the maximum water temperature criteria.





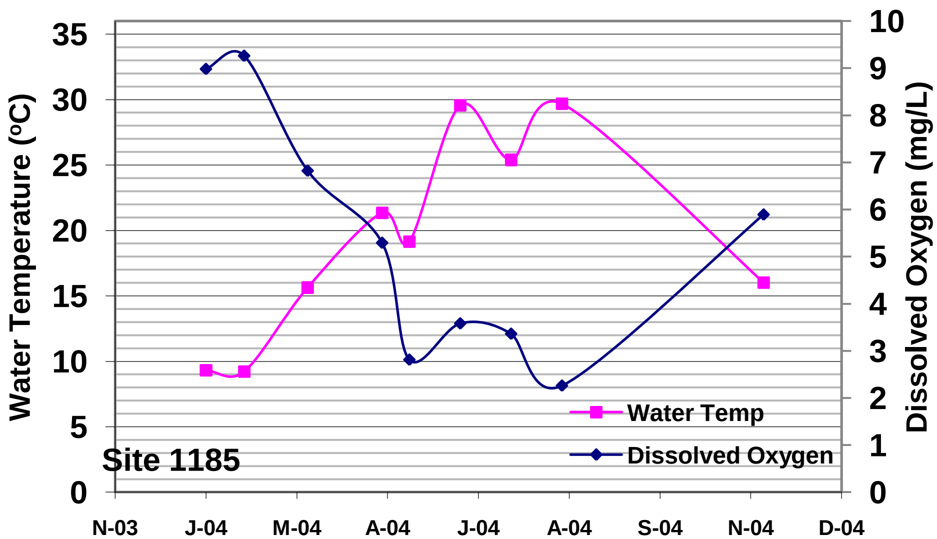


Figure 20. Water temperature and DO data for site 1185.

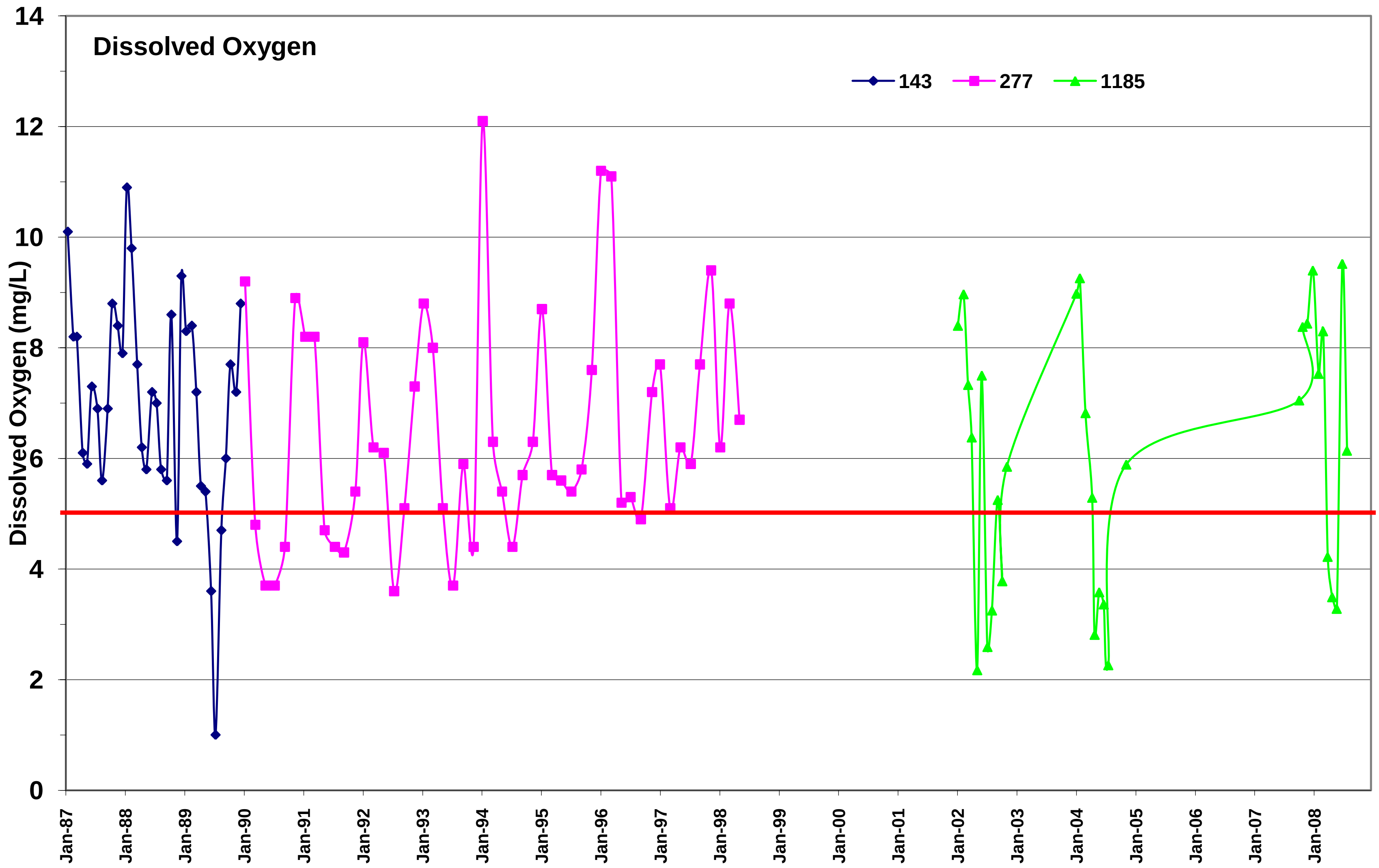


Figure 21. Dissolved Oxygen data for all the sites. Red line marks the minimum DO criteria.

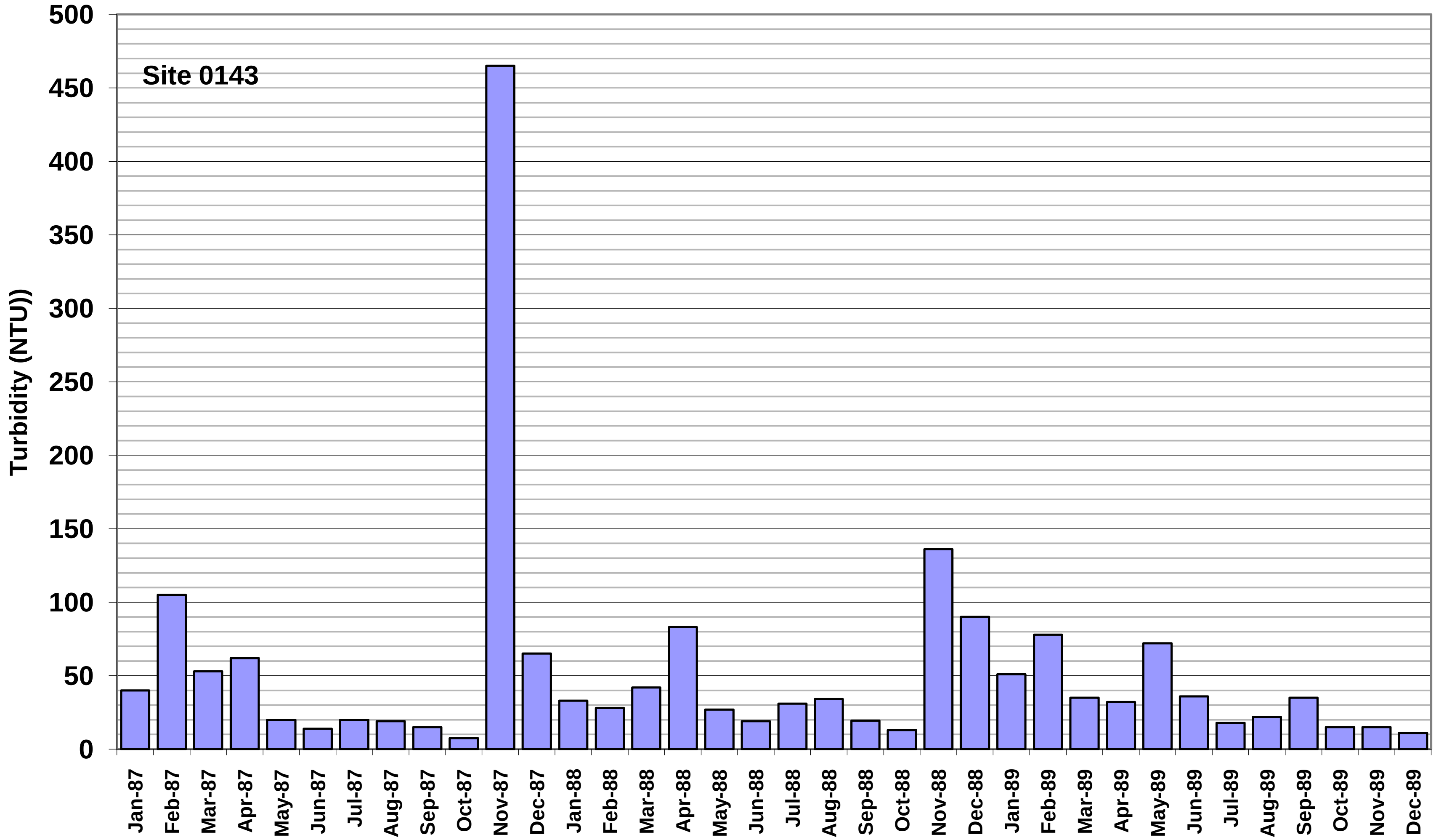


Figure 22. Turbidity water quality data for site 0143.

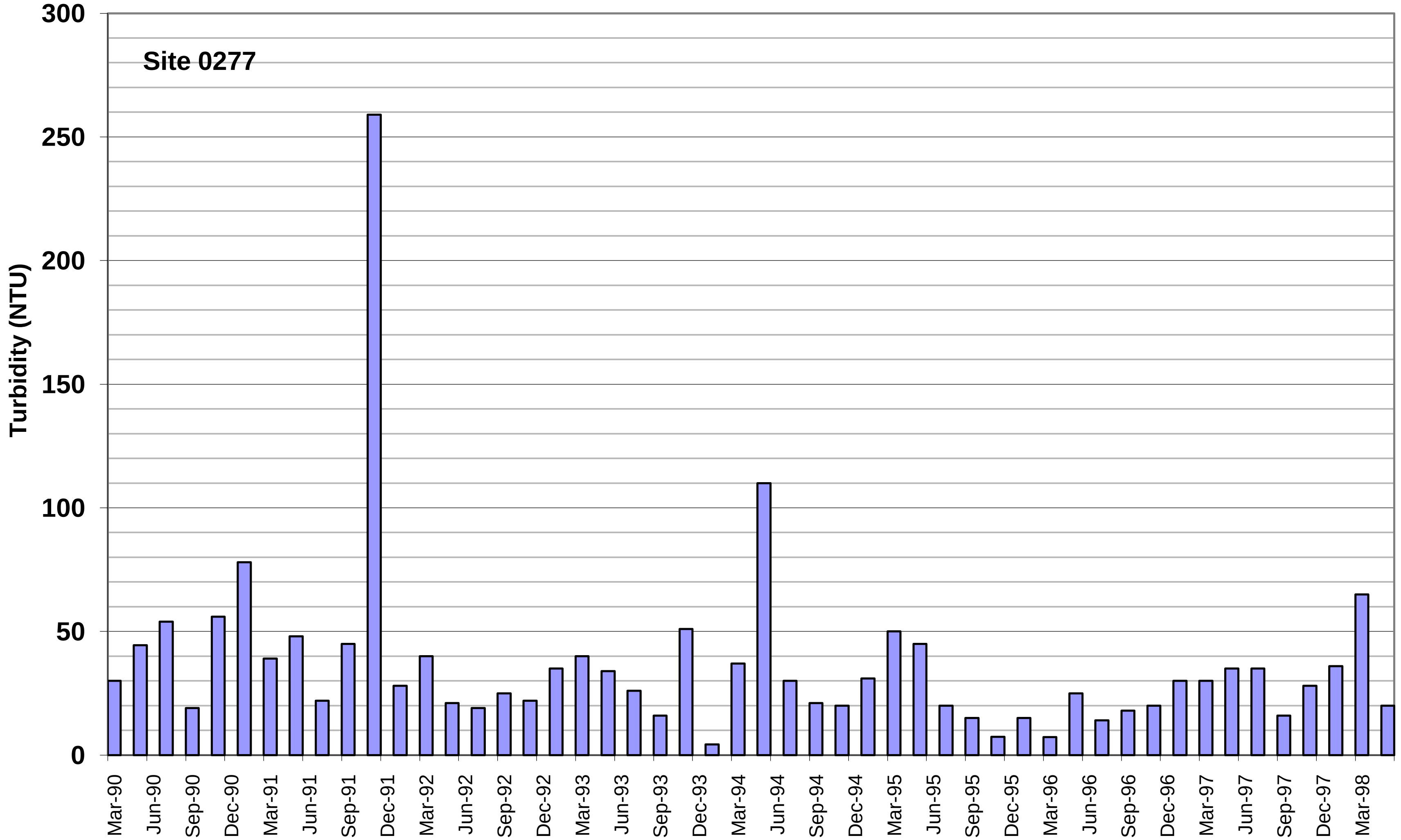


Figure 23. Turbidity water quality data for site 0277.

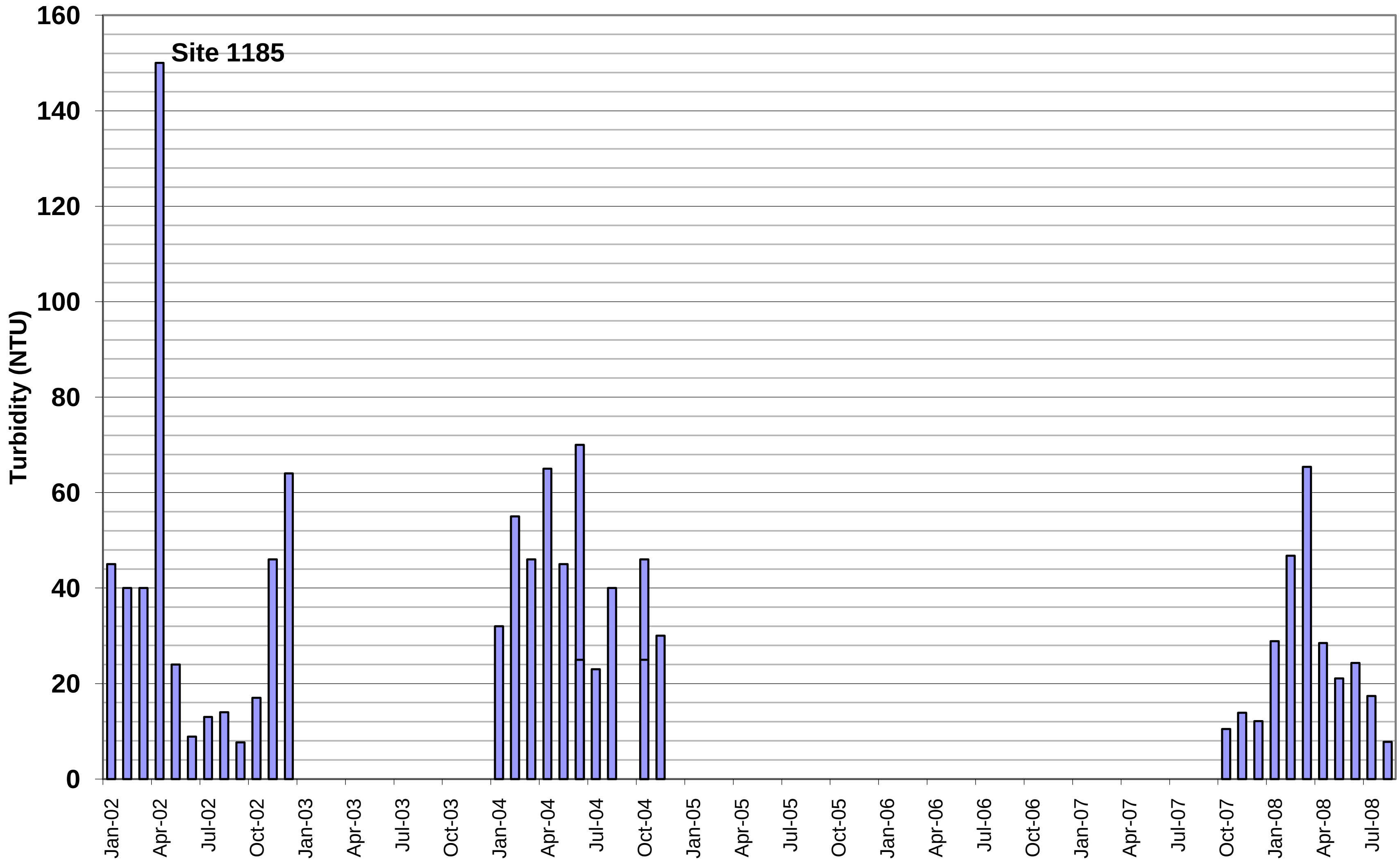


Figure 24. Turbidity water quality data for site 1185.

4.0 TMDL FINDINGS

Total Maximum Daily Loads (TMDLs) are the maximum amount of a pollutant that can be discharged into a water body without causing the water body to become impaired and/or violate state water quality standards. TMDLs are the sum of the individual Waste Load Allocations (WLAs) for point sources, Load Allocations (LAs) for nonpoint and natural background sources, and a Margin of Safety (MOS).

TMDL Allocation = WLA + LA + MOS

Water quality standards are defined based on the designated uses of the water body. Bayou Pierre was listed in Louisiana's 2006 Integrated Report as not fully supporting the designated uses of Fish and Wildlife Propagation. Nitrate/Nitrite, Total Phosphorous, and Dissolved Oxygen were ranked as High Priority for TMDL development.

At the time of the TMDL development for Bayou Pierre, there were seven permitted dischargers. All of the dischargers were considered small and not included in the TMDL because it was unlikely that they had an impact on the bayou.

Also during the TMDL stream survey, only two out of more than 80 tributaries were flowing. Those two tributaries, Shell Bayou and Johnson Chute Bayou, were included in the TMDL model. The TMDL survey was conducted during a period of low flow, therefore, all other tributaries located along Bayou Pierre were assumed to be intermittent for the calibration and the projection modeling.

Additionally, there are six known pumps located on the mainstem of Bayou Pierre. These pumps are used for farming practices in the area. When in use, the pumps can have a significant impact on the flow of Bayou Pierre. Because these pumps are operated intermittently, it is very difficult to quantify their impact. Only two were running during the TMDL survey and were included in the calibration. However, in order to project to critical conditions, no pumps were included in the projections.

In order to model loading into Bayou Pierre, the modeled section of the stream was divided into 13 reaches. A description of these 13 reaches is located in Table 6.

The Clean Water Act requires the consideration of seasonal variation of conditions affecting the constituent of concern, and the inclusion of a margin of safety in the development of a TMDL. Critical conditions for dissolved oxygen were determined for Bayou Pierre using short term water quality data from Bayou Pierre's three water quality sites on the LDEQ Ambient Monitoring Network. The 90th percentile temperature for each season, the corresponding 90% of saturation DO, and the 7Q10 flows were used to produce the critical summer and winter projection loading scenarios.

In order to meet the standard D.O. of 5 mg/L during the summer and winter critical seasons, the man-made nonpoint source loading must be reduced 100% and the natural background loading must be reduced 30%. This shows that Bayou Pierre can not meet the standard during the summer and winter critical seasons, even if every possible BMP was implemented to remove 100% of the man-made NPS loading. This suggests that a more appropriate

D.O. criterion or stream classification is needed for Bayou Pierre.

An individual no load scenario was also run for this stream to identify more appropriate criteria. The model showed that even when 100% of manmade sources are removed, the minimum DO was 3.66mg/L. This shows that the standard D.O. of 5mg/L is inappropriate and it is recommended that a use attainability analysis be conducted on this waterbody.

The sediment oxygen demand (SOD), ultimate nitrogenous biological oxygen demand (UNBOD), and ultimate carbon biological oxygen demand (UCBOD) for each reach are listed in Table 7. The SOD, UNBOD, and UCBOD values for Bayou Pierre were achieved through a calibration model. When the SOD, UNBOD, or UCBOD increases, more oxygen is removed from the water and the DO decreases.

The SOD is the sum of all biological and chemical processes in the sediment that utilize oxygen. The SOD values for Bayou Pierre are higher near the top of the watershed and are zero at the base of the watershed. This is the opposite of what is usually observed in streams. SOD and BOD is generally the highest in the deepest and slowest parts of a stream. Further research may be helpful in determining why SOD is highest at the top of the watershed where the water is shallow. It may be caused by Bayou Pierre Lake, but there is no proof that the lake is the direct cause. Another factor to consider is that the top of the watershed for this particular bayou is not the headwaters. The headwaters of Bayou Pierre are actually in Shreveport in another watershed, therefore the top of subsegment 100606 is simply the continuation of subsegment 100601.

The UNBOD is the total oxygen required for nitrification, which is the biological oxidation of ammonia to nitrate. The highest UNBOD is in the last two reaches of Bayou Pierre, which are also the deepest and widest reaches of the bayou.

The UCBOD is the total oxygen required for the reduction of organic carbon material to CO_2. The level of UCBOD is generally higher at the bottom reaches of the bayou. There is some fluctuation in the UCBOD; there is not a steady rise in the UCBOD towards the base of the bayou.

Table 6. Reaches of Bayou Pierre				
Reach	**Reach Description**	**Length (km)**	**Width (m)**	**Depth (m)**
1	Hwy 509 Bridge [upstream] to Bayou Pierre at Bayou Pierre Lake	4.60	15.545	0.808
2	Bayou Pierre at Bayou Pierre Lake to Hwy 84 Bridge upstream	4.50	17.526	0.837
3	At Hwy 84 Bridge [upstream] to Near Parish Road 609	7.90	16.459	0.754
4	Near Parish Road 609 to Hwy 177	6.60	20.269	0.454
5	Hwy 177 to Near Parish Road 516	10.80	23.165	0.780
6	Near Parish Road 516 to Hwy 174	10.40	24.689	1.527
7	Hwy 174 to Near Transmission Line	11.70	31.852	1.838
8	Near Transmission Line to Upstream from Three League Bayou Distributary and Pump 2	6.80	33.985	2.789
9	Upstream from Three League Bayou Distributary and Pump 2 to Low Water Sill	4.50	36.868	3.796
10	Low Water Sill to Upstream from Johnson Chute	2.60	42.659	3.640
11	Upstream from Johnson Chute to Bayou Pierre at Hwy 11	1.20	47.549	4.043
12	Bayou Pierre at Hwy 11 to Upstream from RR Crossing	5.60	53.035	4.720
13	Upstream from RR Crossing to Upstream from Red River	3.00	57.912	4.711

Table 7. Calibration Model of Oxygen Demand			
Reach	**UNBOD (kg O_2/day)**	**SOD (gm O_2/m^2/day)**	**UCBOD (kg O_2/day)**
1	75	2.4	280
2	390	3.0	550
3	5	2.2	5
4	210	3.3	425
5	210	0.8	1600
6	1475	0.0	5200
7	120	1.8	2800
8	175	0.0	1800
9	575	0.0	2600
10	700	0.0	1210
11	380	0.0	780
12	3000	0.0	6110
13	1900	0.0	3500

5.0 SOURCES OF NONPOINT SOURCE POLLUTION LOADING

Nonpoint source water pollution often results from many different sources in the watershed. Therefore, identifying all the types of land use, the land cover, and the distribution of each type within the watershed boundary is an important key for managing sources of NPS pollution. This type of information provides insight of where and what the sources of NPS pollutant loadings are. Land use activities such as agriculture, urban, forestry and natural systems can contribute to the pollutant loading of the waterway.

The 2006 303(d) list indicates the suspected causes and suspected sources of impairment, which are listed in Table 8. The suspected causes of impairment for Fish and Wildlife Propagation are Nitrate/Nitrite, Dissolved Oxygen, and Total Phosphorus, all of which have a suspected source of natural sources and non-irrigated crop production.

Table 8. 2006 303(d) List of Suspected Causes and Sources

Impaired Use	Suspected Causes of Impairment	Suspected Sources of Impairment
Fish and Wildlife Propagation	Nitrate/Nitrite	Natural Sources and Non-irrigated Crop Production
Fish and Wildlife Propagation	Dissolved Oxygen	Natural Sources and Non-irrigated Crop Production
Fish and Wildlife Propagation	Total Phosphorus	Natural Sources and Non-irrigated Crop Production

5.1 Forestry

Evergreen Forestland and Deciduous Forestland make up about 64% of the Bayou Pierre Watershed. Most of this forestland is located to the west of I-49. There is silviculture activity occurring in these forests, which appears as a checkerboard pattern in satellite photos (Figure 25).

Figure 25. Forestry sites in the watershed.

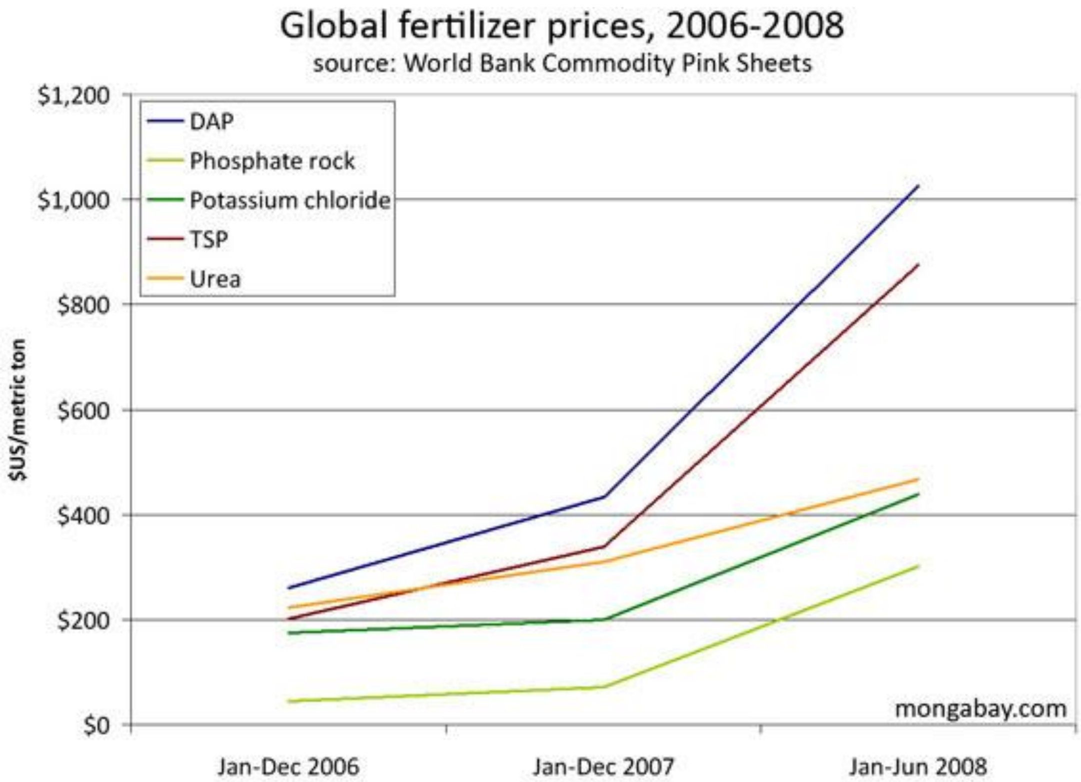
Clearing the land of trees exposes the bare soil. Erosion results in the sediment being carried away by the storm water. Improperly located, constructed and maintained roads are the biggest source of NPS pollution from forestry activities. Removing the trees too close to a stream will result in streambank erosion. Heavy equipment crossing through streams also causes erosion and increases sediment delivered directly into the water body.

5.2 Agriculture

Agriculture occupies the second largest area of land within the Bayou Pierre watershed. The primary agricultural crop is pastureland, but also includes cotton, soybeans, rice, and corn. Nutrient, pesticide, and sediment loading are associated with these activities.

It is suspected that the amount of nitrogen and phosphorus entering the water body may start to decline in the future. Since the price of fertilizer has more than quadrupled from 2006 to 2008, farmers are applying less fertilizer to their land or none at all. As a result, there should be less nutrients in the runoff coming from the watershed in the future.

In addition to less fertilizer being used, there is also less agricultural land in production. In the past few years, cropland and pastureland along the bayou have entered into the Conservation Reserve Program and Wetland Reserve Program.



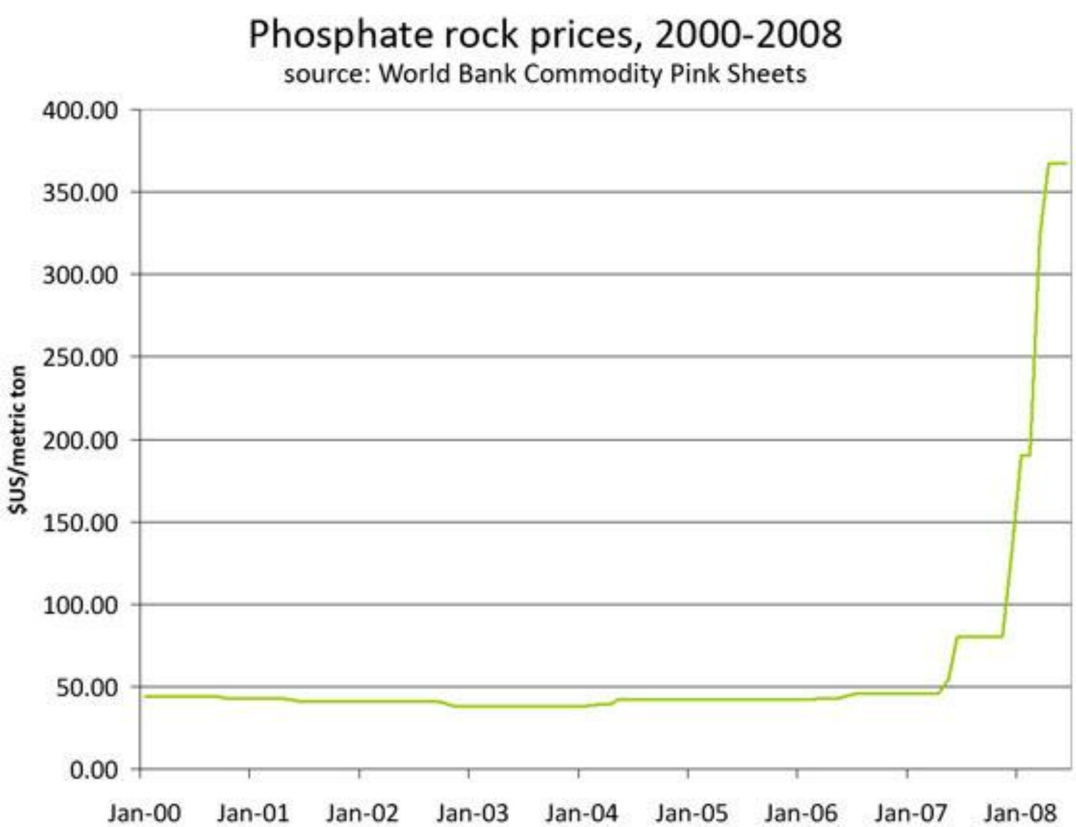


Figure 26. Due to a sudden increase in prices, farmers are fertilizing less.

5.2.1 Pastureland

Pastureland is the most common form of agricultural production in this watershed and is present along the entire length of Bayou Pierre. Pastures require large inputs of fertilizers in order to keep a healthy food supply for the grazing animals and the production of hay. Excessive fertilizer, untimely applications, and applications near the waterways increase the probability of these nutrients getting washed into the bayou. When cattle are allowed continuous access to the stream banks, it increases the rate of bank erosion and deposition of fecal material near the stream. Cattle are attracted to these areas because of shade, water supply, and lush vegetation. Areas having high numbers of cattle that are located near a tributary or drainage are likely to contribute a significant NPS load that can affect the dissolved oxygen, fecal coliform, and nutrients in the river.

5.2.2 Row Crops

Less than 5% of the watershed is used for growing row crops. The common practice for preparing row crops is soil tillage. Erodible soils that have a "K-factor" (soil erodibility factor) greater than 0.4 are more susceptible to erosion when tilled or devoid of vegetation. When rainfall occurs, the soil can be easily washed into the receiving stream. This sediment runoff is often laden with fertilizers, pesticides and herbicides that can result in NPS pollutant loading into the river. If the flow rate in Bayou Pierre is low, the NPS load can deposit and accumulate on the stream bottom. As the seasons progress, warm temperatures increase the rate at which these pollutants degrade, consuming the D.O. in the receiving stream.

When fields are cultivated all the way to the edge of a stream or drainage way, there is no buffer or filtration zone for the runoff coming off the fields. Herbicides are the most common form of weed control and may be utilized as much as five times per year. They are used for weed control in the fields, along the edges of the fields, and drainage ditches. The edge of fields and drainage ways are usually kept "barren" offering almost no conservation of nutrients and soil. The bare stream banks and canals or ditches can result in increased erosion to the bayou.

While there are very little row crops in the watershed, most of them are located in the upper reaches of the bayou.

6.0 NONPOINT SOURCE POLLUTION SOLUTIONS

Implementation of best management practices in the watershed constitutes the building blocks of watershed protection and improving water quality. Since the watershed encompasses a narrow range of land uses, the description of BMPs is divided into categories. Each different category contains site-specific BMPs that minimize a particular source of NPS pollution. BMPs can include structural controls and/or nonstructural controls. Structural controls are those, whether natural or man-made, that can filter, detain, or reroute contaminants carried in surface runoff. Nonstructural controls utilize techniques such as land-use planning, land-use regulations, and land ownership to eliminate or minimize sources generating NPS loading. Some of the most important aspects of successfully implementing BMPs are public awareness, education, and participation. Reduction and prevention of NPS pollution in the watershed will involve a concerted effort from all the stakeholders in it.

6.1 Forestry BMPs

Forestry BMPs are designed primarily to reduce the amount of sediment runoff from forestry operation sites to local bodies of water. In order to minimize the impacts of potential NPS pollutant loads into bodies of water in Bayou Pierre and to sustain future timber harvests, operators should employ management practices that restrict timber harvest from wet areas and utilize select-cut timber harvesting practices. This approach will help maintain the important functions of the forest within the watershed while also sustaining future timber harvests.

The areas of land located along a body of water or stream bank is referred to as the riparian buffer zone, the transitional area between land and water. A riparian zone consists of land adjacent to and including a stream, river, and or other area that is at least periodically influenced by flooding in a natural state. Similar to vegetated filter strips, native plants in the riparian area effectively prevent sediment, chemicals, and organic matter from entering bodies of water. Restricting timber harvest from these areas is a BMP that forestry operations can implement, which can significantly control NPS loads from the site and protect water quality. Unlike filter strips, riparian zones are composed of higher order plants, such as trees and shrubs, as well as grasses, legumes, and wetland plants. Vegetated filter strips can be used in conjunction with riparian areas as an initial filtering component for sediment runoff from a timber site.

Other practices that can be implemented to reduce both direct and indirect NPS loads are “select cut techniques” and “no tree felling within wet areas”. Utilizing select cut techniques helps maintain sustainable forestry operations without impairing its functions in the local environment. A comprehensive list of forestry BMPs with explanation and illustrations of forestry practices is found in the *Louisiana’s Forestry BMP Manual*.

Effective implementation of BMPs will require programs that provide technical information, facts, and incentives for helping foresters. These programs should be designed to create awareness and participation in BMP implementation. LDEQ continues to work cooperatively with all the local and state forest entities to provide statewide forestry educational programs. A list of program activities for forestry is included in the *Louisiana’s Nonpoint Source Management Plan, 2000*.

6.2 Agricultural BMPs

Agricultural BMPs are generally associated with the management of soil, nutrients, pesticides, and water, which are known to be a contributing source of NPS pollutant loading. If fertilizers, herbicides, and pesticides remained in the fields, the NPS load would be less. Therefore, sites should be managed in such a way that the surface runoff rate is not excessive and that it is not contaminated. Reducing NPS loading from agricultural fields will require a concerted effort between all the associated federal, state, and local agencies. Proper management will require agriculture programs which provide environmental education as well as effective production strategies. Agriculture programs should be designed to foster a sense of conservation stewardship for each type of agricultural producer. Examples of these programs are the Louisiana Master Logger Program and the Louisiana Master Farmer Program.

For successful agricultural programs to continue in the watershed, all the cooperating entities will need to participate. The key partners (i.e. NRCS, SWCD, LDAF, LCES, LDNR, and FSA) are the federal, state, and local agencies, which provide funding through cost-share assistance, incentives, expertise through technical assistance, and education through information outreach programs to the farmers. A complete list of agriculture BMPs is provided by the NRCS in the "Technical Guide Handbook". The handbook includes a description of each BMP and their recommended uses. LDEQ has a comprehensive list of BMPs for controlling NPS pollutant loads, programmatic goals and activities, and future objectives and milestones included in the State of Louisiana Water Quality Management Plan, Volume 6, Louisiana's Nonpoint Source Management, 2000.

6.2.1 Pastureland BMPs

Pastureland occupies the largest portion of agricultural land use in the watershed. Pastureland BMPs should focus on measures to control the amount of sediment, nutrients, and fecal coliform in the surface waters draining from the field site. Knowledge of the field sites' delineation and drainage pattern can be helpful when identifying pathways and potential sources of NPS pollutants. During or shortly after a rainfall event is the best time to make this assessment. With this information, the operator can work strategically to implement the BMPs that prevent pollutant sources and/or prevent them from leaving the site.

Vegetative Filter Strip

A general and cost effective practice is to maintain a strip of vegetation around the perimeter of each field site and within the field ditches. The use of native vegetation for cover is encouraged for vegetative filter strips and grassed waterways. If the grassed waterway is covered with wetland plants and/or native grasses, the drainage way can also function as a form of passive biological treatment, which can also reduce NPS loads. The amount of herbicides used should be less, saving costs.

Prescribed Grazing

Field sites having a high population of livestock should consider field rotations to allow for the regrowth of vegetation. Sites with a healthy cover of vegetation have less runoff. If a field site's size is not adequate for field-rotations, ponds could be constructed to capture excess surface runoff from the site. The surface runoff could be routed through a vegetated field ditch, which would work in conjunction with the pond to reduce NPS loading from leaving the site. These practices help to keep the sediment, nutrients, and fecal coliform at the field site.

Riparian Buffer Zone Protection

Protecting the riparian zone along Bayou Pierre, as well as the ditches that run into the bayou, is necessary to prevent sediment, nutrients, and organic matter from entering the bayou. Livestock frequently access these areas to obtain water, shade, and lush vegetation. The hoof traffic along the stream banks can cause serious sediment and fecal coliform loading. Fencing can be used to protect the riparian zone from the damage caused by livestock. When livestock are restricted from the riparian buffer zone, the producer should make accommodations to provide an alternative source of water, shade, and food. Water troughs should be placed on top of a concrete pad to prevent further erosion problems from occurring.

Table 9. Pastureland Best Management Practices Effectiveness		
BMP	**Targeted Pollutant in Surface Water**	**Effectiveness of BMP**
Pasture & hayland planting	Sediment	substantial
Irrigation water management	Sediment	substantial
Critical area planting	Sediment	substantial
Fencing to distribute grazing	Sediment	neutral
Prescribed Grazing	Sediment	substantial
Mechanical Forage Harvest	Sediment	moderate
Irrigation water conveyance	Sediment	moderate
Appropriate irrigation system	Sediment	moderate
Filter strip/buffer	Sediment	moderate
Pond to distribute grazing	Sediment	slight-substantial
Spring development to distribute grazing	Sediment	slight
Brush management	Sediment	slight
Nutrient management	Nutrients	substantial
Waste Utilization	Nutrients	substantial
Irrigation water management	Nutrients	substantial
Pasture & hayland planting	Nutrients	substantial
Use Exclusion to exclude livestock from streams	Nutrients	neutral
Pond	Nutrients	slight-moderate
Buffers	Nutrients	slight-substantial
Fencing to distribute grazing	Nutrients	neutral
Prescribed Grazing	Nutrients	moderate
Forage harvest mgt.	Nutrients	slight-moderate
Waste utilization	Oxygen Demand	moderate
Pond	Oxygen Demand	slight
Nutrient management	Oxygen Demand	substantial
Use Exclusion to exclude livestock from streams	Oxygen Demand	slight-moderate
Fencing to distribute grazing	Oxygen Demand	neutral
Filter strip/buffers	Oxygen Demand	substantial
Prescribed grazing	Oxygen Demand	slight
Forage harvest management	Oxygen Demand	slight
Pasture and hayland planting	Oxygen Demand	slight
Irrigation water management	Oxygen Demand	slight
Waste utilization	Bacteria	neutral
Pond	Bacteria	slight worsening
Nutrient management	Bacteria	slight
Filter strip/buffers	Bacteria	slight
Spring development to distribute grazing	Bacteria	slight
Irrigation water management	Bacteria	substantial

6.2.2 Row crop BMPs

Even though row crops occupy a small portion of agricultural land use in the watershed, implementation of row crop BMPs may help reduce a significant amount of the NPS loading because many of the crops are located near the banks of Bayou Pierre.

Row crop agriculture involves tillage practices that pulverize the soil in order to create a heaping row for planting crops. BMPs for this type of land use should be focused on the management of soil, water, pesticides, and nutrients. These constituents are known to cause NPS pollutant loads, if they are washed into the receiving stream by surface runoff. Controlling the NPS pollutant loading requires implementing BMPs that reduce the amount of surface runoff and the amount of NPS pollutants in it. In addition to implementing BMPs, the producer should develop and utilize pollution prevention strategies such as spill prevention practices for sites where the agro chemicals and fertilizer are stored, off loaded, or prepared for field application.

Conservation Tillage

Conservation tillage practices such as stale seed bed and no till have proven to be successful in producing less NPS loading. These practices utilize bulk organic matter remaining from winter crops as a sponge, while planting directly into it. Leaving bulk material in the fields after harvest is known as residue management, which has a positive effect on surface water quality. Planting soybeans directly into the soil without tillage is another conservation practice. Conservation tillages are designed to reduce the amounts of runoff and rates of flow. In return, there is more sediment, nutrients, and pesticides/herbicides remaining in the fields for growth each growing season. This saves money and reduces the NPS loading.

LDEQ funded a project in the Bayou Wikoff sub-watershed of Bayou Plaquemine Brule in the Mermentau Basin. The purpose of this project was to gather information on the effectiveness of best management practices in reducing nonpoint source pollutants from sugarcane fields. The results indicated that when mulch residue was left on the field after harvest, that total solids could be reduced by 34%, suspended solids by 26%, turbidity by 60% and phosphorus by 8% compared to fields where the sugarcane residue was burned. Therefore, leaving the mulch on the field after harvest will reduce the amount of nonpoint source loadings into the bayou.

Vegetated Filter Strip

A general and cost effective practice is to maintain a strip of vegetation around the perimeter of each field site and within the field ditches. This practice is similar to the BMP referred to as vegetative filter strip or field border and the grassed waterway, except use of native vegetation for cover is encouraged. If the grassed waterway is covered with wetland plants and/or native grasses, the drainage way can also function as a form of passive biological treatment, which can also reduce NPS loads. The amount of herbicides used should be less, saving costs.

Field sites having a high population density should consider field-rotations to allow for re-establishment of vegetation cover and maintenance. Sites with a healthy cover of vegetation have less runoff. If a field site’s size is not adequate for field-rotations, ponds could be constructed to capture excess surface runoff from the site. The surface runoff could be routed through a vegetated field ditch, which would work in conjunction with the pond to reduce NPS loading from leaving the site. These practices help to keep the sediment, nutrients, and fecal coliform at the field site.

The land in and along field ditches, wetlands, and stream banks is very important for preventing sediment, nutrients, and organic matter from entering bodies of water. This area of land between wet and upland landscapes is referred to as the riparian buffer zone. Protecting these areas from continuous livestock grazing is an effective BMP for preventing NPS pollutant loading. Often livestock access these areas for a source of water, shade, and lush vegetation. When livestock are restricted from the riparian buffer zone, the producer should make accommodations to provide an alternative source of water, shade, and food.

Optical Sensors

Recent technological advances in agriculture have enabled the use of optical sensors, which allow varying amounts of fertilizer to be applied to crops instead of one set amount for the entire field. Optical sensors can be mounted on tractors or other fertilizer application systems to deliver precise amounts of fertilizer to plants. By using infrared and near infrared light to assess the health of the crops, an optical sensor can instantly calculate the amount of fertilizer needed to obtain a maximum yield of crop. Since healthy plants absorb more infrared light during photosynthesis and reflect more near infrared light than unhealthy plants, the optical sensors can determine which plants need more fertilizer.

By using these sensors, the over-application of fertilizer can be drastically cut back and less fertilizer will be wasted. It also works equally well at night, when there is less wind drift. In addition to saving money, there will be less fertilizer available in the field to make its way into the runoff. It can also be used to apply herbicide to living weeds, and not waste spray on bare ground or dead weeds.

Precision Land Leveling

Precision land leveling involves cutting or filling a field in order to create a constant slope between 0 to 0.2%. Global positioning systems (GPS) and/or laser-guided instruments are used to create the desired slope. A levee is constructed around the field so that the desired amount of water on the field can be maintained. By keeping the field flooded until ready for planting, there is an increase in nutrient availability and weed control. The water release is controlled while the fields are drained, thus decreasing sediment loading.

All of the BMPs mentioned above are very cost effective and prevent NPS loading. In addition to implementing BMPs, the producer should develop and utilize pollution prevention strategies such as spill prevention practices for sites where the agro chemicals and fertilizer are stored, off loaded, or prepared for field application.

Field Stripcropping

Field stripcropping is the practice of growing crops in a systematic arrangement of strips. The crops are arranged so that a strip of grass or small grains is alternated with a strip of row crops. The strips should be approximately the same width. The strips of grass slow runoff, increase the infiltration of water into the soil, and trap sediment moving from the crop strips.

Table 10. Cropland Best Management Practices Effectiveness			
BMP	**Targeted Pollutant in Surface Water**	**Effectiveness of BMP**	**Crops**
Mulch Till	Sediment	slight	1,2,4-6
No Till	Sediment	moderate	1,2,4-6
Ridge Till	Sediment	slight-moderate	1-3,5,6
Contour farming	Sediment	moderate	1,2,5,6
Grassed waterway	Sediment	slight-moderate	1-6
Residue Mgt.,Seasonal	Sediment	slight	1-6
Grade stab strut.	Sediment	slight-moderate	1-6
Cons. crop. rot.	Sediment	slight-moderate	1-6
Irrig.Water mgt.	Sediment	moderate	1-6
Tailwater rec.	Sediment	slight	1-6
Struct. water cont.	Sediment	slight	1-6
Water & sed. basin	Sediment	moderate-substantial	1,2,5,6
Sediment basin	Sediment	substantial	1,2,5,6
Irrig. leveling	Sediment	slight	1-6
Field border	Sediment	slight-moderate	1,2,5,6*
Cover crop	Sediment	slight-moderate	1-6
Deep Tillage	Sediment	slight-moderate	1-6
Filter strips/buffers	Sediment	substantial	1,2,4-6*
Diversion	Sediment	medium	1,2,5,6
Nutrient Mgt.	Soluble Nutrients	substantial	1-6
Waste utilization	Soluble Nutrients	slight	1-6
Irrig.Water mgt.	Soluble Nutrients	slight	1-6
Tailwater rec.	Soluble Nutrients	slight	1-6
Land leveling	Soluble Nutrients	slight	1-6
Irrig. system	Soluble Nutrients	slight	1-6
Field border	Soluble Nutrients	slight	1-6*
Cover crop	Soluble Nutrients	slight	1-6
Deep tillage	Soluble Nutrients	slight	1-6
Cons. crop. rot.	Soluble Nutrients	slight	1-6
Mulch till	Soluble Nutrients	slight	1,2,4-6
No till	Soluble Nutrients	slight	1,2,4-6
Ridge till	Soluble Nutrients	slight	1-6
Crop residue,Seasonal	Soluble Nutrients	slight	1-6
Water & sed. basin	Soluble Nutrients	slight	1,2,5,6
Terrace	Soluble Nutrients	slight	1,2,5,6
Sediment basin	Soluble Nutrients	substantial	1,2,5,6
Filter strips/buffers	Soluble Nutrients	substantial	1-6*
Contour farming	Soluble Nutrients	slight	1,2,5,6
Stripcropping	Soluble Nutrients	slight	1,2,5,6
Grassed waterway	Soluble Nutrients	slight	1-6 ***
Waste utilization	Adsorbed Nutrients	moderate	1-6
Irrig.Water mgt.	Adsorbed Nutrients	substantial	1-6
Tailwater rec.	Adsorbed Nutrients	moderate	1-6
Land leveling	Adsorbed Nutrients	moderate	1-6
Irrig. system	Adsorbed Nutrients	substantial	1-6
Field border	Adsorbed Nutrients	moderate	1-6*
Cover crop	Adsorbed Nutrients	moderate	1-6

Deep tillage	Adsorbed Nutrients	substantial	1-6
Cons. crop. rot.	Adsorbed Nutrients	moderate	1-6
Mulch till	Adsorbed Nutrients	moderate	1,2,4-6
No till	Adsorbed Nutrients	slight	1,2,4-6
Ridge till	Adsorbed Nutrients	slight	1-6
Crop residue Seasonal	Adsorbed Nutrients	slight	1-6
Water & sed. basin	Adsorbed Nutrients	moderate	1,2,5,6
Terrace	Adsorbed Nutrients	moderate	1,2,5,6
Contour farming	Adsorbed Nutrients	substantial	1,2,5,6
Stripcropping	Adsorbed Nutrients	substantial	1,2,5,6
Grassed waterway	Adsorbed Nutrients	moderate	1-6 ***
Waste utilization	Oxygen Demand	slight	1-6
Field border	Oxygen Demand	mod	1,2,5,6*
Filter strips/buffers	Oxygen Demand	sub	1,2,5,6*
Terrace	Oxygen Demand	moderate	1,2,5,6
Contour farming	Oxygen Demand	mod	1,2,5,6
Stripcropping	Oxygen Demand	mod	1,2,5,6
Water & sed. basin	Oxygen Demand	mod	1,2,5,6
Sediment basin	Oxygen Demand	sub	1,2,5,6
Diversion	Oxygen Demand	neutral	1,2,5,6
Irrig Water mgt.	Oxygen Demand	slight	1-6
Irrig. system	Oxygen Demand	slight	1-6
Deep tillage	Oxygen Demand	slight	1-6
Waste utilization	Bacteria	neutral	1-6
Field border	Bacteria	slight	1,2,5,6*
Filter strips/buffers	Bacteria	slight	1,2,5,6*
Terrace	Bacteria	moderate	1,2,5,6
Contour farming	Bacteria	slight	1,2,5,6
Stripcropping	Bacteria	slight	1,2,5,6
Water & sed. basin	Bacteria	slight	1,2,5,6
Sediment basin	Bacteria	mod	1,2,5,6
Diversion	Bacteria	slight	1,2,5,6
Irrig Water mgt.	Bacteria	substantial	1-6
Irrig. system	Bacteria	slight	1-6
Deep tillage	Bacteria	slight	1-6

1 = cotton, 2 = soybeans, 3 = sugarcane, 4 = rice, 5 = corn, 6 = truck crops
* Fields not artificially drained.
**Fields not artificially drained.
*** Chemical maintenance of vegetation may adversely affect the quality of runoff water.

Median of Average Influent and Effluent Concentrations of Best Management Practices

Constituents	Sample Location	Detention Pond (n=25)[1]	Wet Pond (n=46)[1]	Wetland Basin (n=19)[1]	Biofilter (n=57)[1]	Media Filter (n=38)[1]	Hydrodynamic Devices (n=32)[1]	Porous Pavement (n=6)[1]
Suspended Solids (mg/L)	Influent	72.65 (41.70-103.59)	34.13 (19.16-49.10)	37.76 (18.10-53.39)	52.15 (41.41-62.88)	43.27 (27.25-59.58)	39.61 (21.95-76.27)	xx
	Effluent	31.04 (16.07-46.01)	13.37 (7.29-19.45)	17.77 (9.26-26.29)	23.92 (15.07-32.78)	15.86 (9.74-21.98)	37.67 (21.28-54.02)	16.96 (5.90-48.72)
Total Cadmium (µg/L)	Influent	0.71 (0.45-1.28)	0.49 (0.20-0.79)	0.36 (0.11-0.60)	0.54 (0.40-0.67)	0.25 (0.12-0.49)	0.74 (0.37-1.11)	xx
	Effluent	0.47 (0.25-0.87)	0.27 (0.12-0.61)	0.24 (0.11-0.55)	0.30 (0.26-0.35)	0.19 (0.1-0.37)	0.57 (0.25-1.33)	xx
Dissolved Cadmium (µg/L)	Influent	0.24 (0.15-0.33)	0.19 (0.10-0.28)	xx	0.25 (0.21-0.28)	0.16 (0.11-0.21)	0.33 (0.11-0.55)	xx
	Effluent	0.25 (0.17-0.36)	0.11 (0.08-0.15)	xx	0.21 (0.19-0.23)	0.13 (0.10-0.18)	0.31 (0.13-0.71)	xx
Total Copper (µg/L)	Influent	20.14 (8.41-31.79)	8.91 (5.29-12.52)	5.65 (2.67-38.61)	31.93 (25.25-38.61)	14.57 (10.87-18.27)	15.42 (9.20-21.63)	xx
	Effluent	12.10 (5.41-18.80)	6.36 (4.70-8.01)	4.23 (0.62-7.83)	10.66 (7.68-13.68)	10.25 (8.21-12.29)	14.17 (8.33-20.01)	2.78 (0.88-8.78)
Dissolved Copper (µg/L)	Influent	6.66 (0.73-12.59)	7.33 (5.40-9.26)	xx	14.15 (10.14-18.16)	7.75 (4.55-10.96)	13.59 (9.82-17.36)	xx
	Effluent	7.37 (3.28-11.45)	4.37 (3.73-5.73)	xx	8.40 (5.65-11.45)	9.00 (7.28-10.72)	13.92 (4.40-23.44)	xx
Total Chromium (µg/L)	Influent	7.36 (5.49-9.88)	6.00 (3.58-10.08)	xx	5.63 (4.49-7.05)	2.18 (1.66-2.86)	4.07 (2.39-6.91)	xx
	Effluent	3.18 (2.10-4.84)	1.44 (0.79-2.66)	xx	4.64 (3.08-6.98)	1.48 (0.82-2.70)	3.52 (2.14-5.80)	xx
Total Lead (µg/L)	Influent	25.01 (12.06-37.95)	14.36 (8.32-20.40)	4.62 (1.43-11.89)	19.53 (10.11-28.95)	11.32 (6.09-16.55)	18.12 (5.70-30.53)	xx
	Effluent	15.77 (4.67-26.87)	5.32 (1.63-9.01)	3.26 (2.31-4.22)	6.70 (2.81-10.59)	3.76 (1.08-6.44)	10.56 (4.27-16.85)	7.88 (1.64-37.96)
Dissolved Lead (µg/L)	Influent	1.25 (0.33-2.17)	3.40 (1.12-5.68)	0.50 (0.33-0.67)	2.25 (0.77-3.74)	1.44 (1.05-1.82)	1.89 (0.83-2.95)	xx
	Effluent	2.06 (0.93-3.19)	2.48 (0.98-5.36)	0.87 (0.85-0.89)	1.96 (1.26-2.67)	1.18 (0.77-1.60)	3.34 (2.22-4.47)	xx
Total Zinc (µg/L)	Influent	111.56 (51.50-171.63)	60.75 (45.23-76.27)	47.07 (24.47-90.51)	176.71 (128.28-225.15)	92.34 (52.29-132.40)	119.08 (73.50-164.67)	xx
	Effluent	60.20 (20.70-99.70)	29.35 (21.13-37.56)	30.71 (12.80-66.69)	39.83 (28.01-51.56)	37.63 (16.80-58.46)	80.17 (52.72-107.61)	16.60 (5.91-46.64)

Dissolved Zinc (µg/L)	Influent	26.11 (5.20-75.10)	47.46 (37.65-57.27)	xx	58.31 (32.46-79.16)	69.27 (37.97-100.58)	35.93 (4.96-66.90)	xx
	Effluent	25.84 (10.75-40.93)	32.86 (17.70-48.01)	xx	25.40 (18.71-32.09)	51.25 (29.04-73.46)	42.46 (10.38-74.55)	xx
Total Phosphorus (mg/L)	Influent	0.19 (0.17-0.22)	0.21 (0.13-0.29)	0.27 (0.11-0.43)	0.25 (0.22-0.28)	0.20 (0.15-0.26)	0.24 (0.01-0.46)	xx
	Effluent	0.19 (0.12-0.27)	0.12 (0.09-0.16)	0.14 (0.04-0.24)	0.34 (0.26-0.41)	0.14 (0.11-0.16)	0.26 (0.12-0.48)	0.09 (0.05-0.15)
Dissolved Phosphorus (mg/L)	Influent	0.09 (0.06-0.13)	0.09 (0.06-0.13)	0.10 (0.04-0.22)	0.09 (0.07-0.11)	0.09 (0.03-0.14)	0.06 (0.01-0.11)	xx
	Effluent	0.12 (0.07-0.18)	0.08 (0.04-0.11)	0.17 (0.03-0.31)	0.44 (0.21-0.67)	0.09 (0.07-0.11)	0.09 (0.04-0.13)	xx
Total Nitrogen (mg/L)	Influent	1.25 (0.83-1.66)	1.64 (1.39-1.94)	2.12 (1.58-2.66)	0.94 (0.94-1.69)	1.31 (1.19-1.42)	1.25 (0.33-2.16)	xx
	Effluent	2.72 (1.81-3.63)	1.43 (1.17-1.68)	1.15 (0.82-1.62)	0.78 (0.53-1.03)	0.76 (0.62-0.89)	2.01 (1.37-2.65)	xx
Nitrate-Nitrogen (mg/L)	Influent	0.70 (0.35-1.05)	0.36 (0.21-0.51)	0.22 (0.01-0.47)	0.59 (0.44-0.73)	0.41 (0.30-0.51)	0.40 (0.06-0.73)	xx
	Effluent	0.58 (0.25-0.91)	0.23 (0.13-0.37)	0.13 (0.07-0.26)	0.60 (0.41-0.79)	0.82 (0.60-1.05)	0.51 (0.08-1.34)	xx
TKN (mg/L)	Influent	1.45 (0.97-1.94)	1.26 (1.03-1.49)	1.15 (0.81-1.48)	1.80 (1.62-1.99)	1.52 (1.07-1.96)	1.09 (0.52-1.67)	xx
	Effluent	1.89 (1.58-2.19)	1.09 (0.87-1.31)	1.05 (0.82-1.34)	1.51 (1.24-1.78)	1.55 (1.22-1.83)	1.48 (0.87-2.47)	1.23 (0.44-3.44)

Chart from www.bmpdatabase.org. The efficiency is not reported as a percentage of pollutant removal because Percent Removal is primarily a function of influent quality.

7.0 Making the Implementation Plan Work

In order to implement BMPs and other conservation practices which reduce the NPS load in the Bayou Pierre watershed so that it meets its designated uses and is no longer listed on the 303(d) list, it will be necessary to have programs that provide technical assistance, funding, incentives, as well as foster a sense of stewardship. Many of these programs that are designed to assist the landowner are already in place. The LDEQ's Nonpoint Source Unit provides monies distributed through the USEPA under Section 319 of the CWA. The funds are utilized to implement BMPs for all types of land uses within the watershed in order to reduce and/or prevent the NPS pollutants and achieve the river's designated uses. The USDA and NRCS are federal government agencies that have several such programs made available by way of the Farm Security and Rural Investment Act of 2002. These programs are made available through the local Soil and Water Conservation District (SWCD). The NRCS has a list of BMPs for almost all types of agriculture and programs to facilitate their use.

Parish-wide cooperation and coordination will be necessary in order to protect the water quality within the watershed. Though challenging, it is an opportunity and reason for leaders, officials, and local citizens to come together for a common interest. The watershed approach helps build new levels of cooperation and coordination, which is necessary to successfully control NPS loading.

7.1. Regulatory Authority

Section 319 of the Clean Water Act (PL 100-4, February 4, 1987) was enacted to specifically address problems attributed to nonpoint sources of pollution. Its objective is to restore and maintain the chemical, physical, and biological integrity of the nation's waters (Sec. 101; PL 100-4). Section 319 directs the governor of each state to prepare and submit a nonpoint source management program for reduction and control of pollution from nonpoint sources to navigable waters within the state by implementation of a four-year plan, submitted within 18 months of the day of enactment.

In response to the federal law, the State of Louisiana passed the Revised Statute 30:2011, which had been signed by the Governor in 1987, as Act 272. Act 272 designated LDEQ as the Lead Agency to develop and implement the State's Nonpoint Source Management Plan. LDEQ's Water Quality Assessment Division was charged with the responsibility to protect and preserve the quality of waters in the State and has developed the nonpoint source management program, ground water quality program and a conservation and management plan for estuaries. These programs and plan were developed in coordination with the appropriate State agencies such as the Department of Natural Resources, the Department of Wildlife and Fisheries, the Department of Agriculture and Forestry and the State Soil and Water Conservation Committees in various jurisdictions (La.R.S. 30:20). LDEQ's Water Quality Assessment Division is responsible for managing federal funds to implement projects that will restore and improve water quality, providing matching State funds when required and complying with terms and conditions necessary to receive federal grants.

The water quality standards are described in LAC 33:IX.1101.D in chapter 11 (LDEQ, 2003). These standards are applicable to surface waters of the state and are utilized through the waste load allocation and permit process to develop effluent limitations for point source discharges to surface waters of the State. The water quality standards also form the basis for implementing the best management practices for control of nonpoint sources of water pollution.

Chapter 11 also describes the anti-degradation policy (LAC 33:IX.1109.A.2) which states that the administrative authority will not approve any wastewater discharge or certify any activity for federal permit that would impair water quality or use of state waters. Waste discharges must comply with applicable state and federal laws for the attainment of water quality goals. Any new, existing, or expanded point source or nonpoint source discharging into state waters, including land clearing, which is the subject of a federal permit application, will be required to provide the necessary level of waste treatment to protect state waters as determined by the administrative authority. Further, the highest statutory and regulatory requirements shall be achieved for all existing point sources and best management practices (BMPs) for nonpoint sources. Additionally, no degradation shall be allowed in high-quality waters that constitute outstanding natural resources, such as waters of ecological significance as designated by the office. Those water bodies presently designated as outstanding resources are listed in LAC 33:IX.1123.

7.2. Actions Being Implemented by LDEQ

The LDEQ is presently designated the lead agency for implementation of the Louisiana Nonpoint Source Program. The LDEQ Nonpoint Source Unit receives the base funds while the Louisiana Department of Agriculture and Forestry (LDAF) receives the incremental funds of the §319(h) grant monies. These funds are used to assist in the implementation of BMPs and to address water quality problems on sub-segments listed on the §303(d) list. USEPA §319(h) funds are utilized to sponsor cost sharing, monitoring, and education projects. These monies are available to all private, for profit, and nonprofit organizations that are authenticated legal entities, or governmental jurisdictions including: cities, counties, tribal entities, federal agencies, or agencies of the State. Presently, LDEQ is cooperating with such entities on nonpoint source projects which are active throughout the state.

Contact was made with the Twin Valley RC&D and the NRCS Shreveport/Mansfield Field Office. A guided tour of the Bayou Pierre Watershed was given to LDEQ by the Coordinator of the Twin Valley RC&D on October 27, 2008. In addition to ideas relating to what needs to be done to reduce the nonpoint source pollution, notes and pictures were taken concerning the condition of the area. The LDEQ has entered into a cooperative agreement with the Twin Valley RC&D to serve as the watershed coordinator and to lead discussions with stakeholders in the Bayou Pierre watershed.

Open discussion among stakeholders and project technical advisory groups will be encouraged. Project organizers may promote a template in which the opinions and concerns of stakeholders would weigh heavily into the final decisions regarding nutrient reduction goals and the selection of best management practices to achieve them. Stakeholders representing the various constituencies of the Bayou Pierre Watershed will be able to advise project leaders on the feasibility and acceptance of various aspects of the Watershed Implementation Plan.

Project leadership may determine that an efficient use of stakeholder time and effort may be to subdivide the group into separate work groups to focus on the individual issues and best management practices targeted for urban, rural, and educational areas of concern. Having rosters for each work group may ensure adequate representation of stakeholder interests.

7.3. Actions Being Implemented by other Agencies

Louisiana Department of Agriculture and Forestry

The LDAF has worked on development of action items that were contained in the Comprehensive Management Plan. Their soil and water conservation districts are the primary link with the farmers and landowners that can implement best management practices on their lands. As the Action Items contained with the management plan are addressed, these districts will continue to play a major role in their implementation.

Police Juries

Louisiana is unique in the nation in that it has parishes that are governed in most cases by police juries. The jury system provides government close to the people. The jury performs the legislative functions of enacting ordinances, establishing programs and setting policy. It is also an administrative body in that it is involved in preparing the budget, hiring and firing personnel, spending funds, negotiating contracts and in general, directing the activities under its supervision. The Police Jury of Natchitoches Parish, Red River, Sabine, De Soto, and the Caddo Parish Commission are five local governing bodies as well as sponsors of the Bayou Pierre Cooperative River Basin Study.

Master Farmers

The Master Farmer Program (developed by Louisiana State University Agricultural Center) is to encourage on the ground BMP implementation with a focus on environmental stewardship. The LSU AgCenter is promoting the Master Farmer Program to help farmers address environmental stewardship through voluntary, effective, and economically achievable BMPs. The program will be implemented through a multi-agency organization partnership, including the Louisiana Farm Bureau (LFB), the Natural Resources Conservation Service (NRCS), the Louisiana Cooperative Extension Service (LCES), USDA-Agriculture Research Service (ARS), LDEQ, and agricultural producers.

The Master Farmer Program will have three components: environmental stewardship, agricultural production, and farm management. The environmental stewardship component will have three phases. Phase I will focus on the environmental education and crop-specific BMPs and their implementation. Phase II of the environmental component will include in-the-field viewing of implemented BMPs on “Model Farms.” Farmers will be able to see farms that document BMP effectiveness in reducing sediment runoff. Phase III will involve the development and implementation of farm-specific, comprehensive conservation plans by the participants. A member must participate in all three phases in order to gain program status.

This program can help to initiate and distribute the use of BMPs throughout the watershed. Participants will set an example for the rest of the agricultural community and will work closely with NRCS staff and other Master Farmers to identify potential problem areas in the watershed. They will receive information on new and innovative ways to reduce soil and nutrient loss from their fields. They will be kept informed of the water quality monitoring occurring in the watershed and alerted of any degradation or improvements. Farmers, who participate and complete the Master Farmer Program, receive the distinction of a "master farmer", which implies that they have completed all the coursework in environmental stewardship, production, and management/marketing. Voluntary implementation of economically achievable and effective BMPs represents a workable means of reducing agriculture's contribution to the water quality problems.

Department of Health and Hospitals

The DHH has worked on nonpoint source problems associated with home sewage systems across the Red River Basin. In many areas, they have inventoried these systems and determined where maintenance problems exist or new systems need to be installed. DHH will continue to play a major role in addressing pollution that is associated with home sewage systems.

Local Civic Organizations

The local civic and service organizations are comprised of key leaders within the community. These people care about their community and want to work on programs that improve the environment and their local economy. They are the farmers, the homeowners, and the city and parish leaders that need to be involved in programs that educate the people about their water quality issues. They will be included in the educational outreach programs planned for TMDLs and watershed management and are viewed as local decision-makers in how these programs are implemented.

Local Universities, Schools

Universities and schools have such an opportunity to become involved in water quality, habitat protection and wetland issues that exist across the Red River Basin. Many of them have and already conduct their own water quality testing programs and have become involved in environmental education. As LDEQ works on watershed implementation, there will be opportunity for their involvement in many aspects of the programs. Surveys of home sewage systems, habitat assessment along bayous and streams, participation in demonstration projects and educational programs are all examples of activities that local schools and university students and teachers can become involved in. In some parts of the state, students have restored urban streams and worked with the Corp of Engineers to protect wetlands. They have innovative ideas and enjoy working on local issues where short-term progress can be seen.

Louisiana Cooperative Extension Service

LCES plays a very important role in the educational component of the NPS Management Program. They provide the farmers, local citizens, and science teachers and children with information on water quality, wetlands, habitat protection and a host of other environmental issues. Summer camps offer high school students the opportunity to learn about coastal environments, marshes, and estuaries. Marsh Maneuvers has been a very popular learning experience for students to actually spend a week in the marsh, learning about every aspect of its unique ecology. LCES has hosted and participated in workshops for science teachers on water quality, nonpoint source pollution, watershed management and wetland protection. They are the backbone of the state's educational system for adults and children on agriculture and environmental issues, and it is anticipated that they will continue to be a major partner in this important area.

USDA and NRCS

The U.S. Department of Agriculture (USDA) and Natural Resource Conservation Service (NRCS) offers landowners financial, technical, and educational assistance to implement conservation practices and/or BMPs on privately owned land to reduce soil erosion, improve water quality, and enhance crop land, forest land, wetlands, grazing lands and wildlife habitat.

The new Food, Conservation, and Energy Act of 2008, known as the 2008 Farm Bill, will provide conservation opportunities for farmers and ranchers for years to come. The new provisions build on the conservation gains made by farmers and ranchers through the 1985, 1996 and 2002 Farm Bills. They simplify existing programs and create new programs to address high priority environmental goals. Although most of these programs are designed to assist the agriculture industry, there may be cases where they may be utilized for conservation practices for other types of land uses.

A complete list of agriculture BMPs is provided by the NRCS in their "Technical Guide Handbook". The handbook includes a description of each BMP and their recommended uses. Each BMP is listed by a "code", i.e. Field Border (386). The following includes a brief summary of the programs available through the local SWCD under the oversight of USDA and NRCS. The descriptions of the programs are general and are based on information available at the time; key points subject to change as rules established.

2008 Farm Bill Conservations Programs and Potential Funding Sources:

Environmental Quality Incentive Program (EQIP) provides 75% - 90% cost share for environmentally beneficial structural and management alterations, primarily 60% to livestock operations. Applications prioritized for benefits. Considered the "Working Lands" program. 2008 Farm Bill total funding allocation is $13,546,218.

Wildlife Habitat Incentive Program (WHIP) provides 75% - 90% cost share for the costs of wildlife habitat restoration and enhancement on private lands. Eligible to private property owners (and lessees) for installing riparian buffers, native pine & hardwoods, wildlife corridors, and other wildlife enhancing measures, 5 – 10 year contracts. The 2008 Farm Bill total funding allocation is $660,314. The 2008 Farm Bill has applied 7,964 acres in this program.

Wetland Reserve Program (WRP) is a voluntary program for wetland restoration, enhancement, and protection on private lands. WRP provides annual payments and restoration costs for 10 year, 30 year, or perpetual easements on prior converted wetlands. Louisiana leads the US in WRP participation. The 2008 Farm Bill has applied 11,803 acres in this program and expanded the program to purchase long-term easements and cost sharing to agriculture producers.

Conservation Reserve Program (CRP)
The 1985 Farm Bill established CRP as a voluntary program to protect highly erodible and environmentally sensitive lands. Has a positive value on rural environment by improving soil, water, and wildlife. Extends a pilot sub-program called the Conservation Reserve Enhancement program. The 2008 Farm Bill has applied 41,934 acres in this program.

Conservation Security Program (CSP) is a new national incentive payment program for maintaining and increasing farm and ranch stewardship practices. The CSP is designed to correct a policy disincentive in which independently conducted resource stewardship has disqualified many farmers from receiving conservation program assistance. Features an optional "tiered" level of farmer participation where higher tiers receive greater funding for greater conservation practices. The 2008 Farm Bill has applied 65 acres in this program.

Grassland Reserve Program (GRP) is a voluntary program that helps landowners and operators restore and protect grassland, including rangeland, pastureland, shrubland, and certain other lands, while maintaining the areas as grazing lands. GRP easements would be divided 40/60 between agreements of 10, 15, or 20-years and agreements and easements for 30-years and permanent easements to restore grassland, rangeland, and pasture through annual rental payments. The 2002 Farm Bill established GRP and authorizes $254 million in funding for 2 million acres through 2007.

Small Watershed Rehabilitation Program (SWRP) provides essential funding for the rehabilitation of aging small watershed impoundments and dams that have been constructed over the past 50 years. The 2002 Farm Bill the established program and the total funding allocation is $275 million through 2007.

"Sodbuster" is a conservation compliance requirement that was established by the 1985 Farm Bill to discourage plowing of erosion-prone grasslands for use as cropland. Eligibility for program benefits is tied to an approved conservation plan. Compliance is required.

"Swampbuster" was established in the 1985 Farm Bill as a conservation compliance mechanism to discourage draining of wetlands for use as cropland. Eligibility for program benefits can be lost for any wetland converted after 12/23/85. Compliance is required.

In addition to the programs mentioned, the following organizations have signed an MOU with LDEQ within the state's NPS Management Plan that each will aid LDEQ in achieving the goals of the management plan:

Louisiana Department of Agriculture and Forestry
Louisiana Department of Health and Hospitals
Louisiana Department of Wildlife and Fisheries
Louisiana Department of Transportation and Development
Louisiana Department of Natural Resources
Louisiana State University Agricultural Center
Natural Resources Conservation Service
USDA – Farm Services Agency
Louisiana Forestry Association
US Fish and Wildlife Service
USDA Forest Service
US Army Corps of Engineers
US Geological Survey
Federal Emergency Management Agency
Louisiana Farm Bureau Federation

7.4. Implementation and Maintenance

The following chart lists the average costs of installing different types of BMPs that would be useful in the Bayou Pierre watershed.

Table 11. Cost of BMP Implementation.

Practice Code	Practice Name	Component	Unit Type	2008 State Average Cost ($)
100	Comprehensive Nutrient Management Plan	Comprehensive Nutrient Management Plan	no	350.00
327	Conservation Cover	Native species, 1 to 2 species (seedbed prep, seed, planting)	ac	92.00
329	Residue and Tillage Management, No-Till/Strip-Till/Direct Seed	No Till	ac	25.00
330	Contour Farming	Contour Farming	ac	5.00
338	Prescribed Burning	Prescribed Burning	ac	25.00
340	Cover crop	Establishment of small grain for seasonal cover	ac	31.00
342	Critical Area Planting	Establishment of permanent cover (seedbed Prep, seed, and seeding)	ac	210.00
350	Sediment Basin	Sediment Basin (installed, mobilization, earthwork, outlet structure)	cy	2.45
382	Fence	4 Strand Barbed Wire (materials and labor)	lf	1.63
386	Field Border	Native species, 1 to 2 species (seedbed prep, seed, planting)	ac	92.00
393	Filter Strip	Native species, 1 to 2 species (seedbed prep, seed, planting)	ac	92.00
412	Grassed Waterway	Waterway (installed, mobilization, excavation)	cy	2.10
462	Precision Land Forming	125 to 205 cy per ac (installed , mobilization, earthwork)	ac	252.00
464	Irrigation Land Leveling	125 to 205 cy per ac (installed , mobilization, earthwork)	ac	252.00
490	Forest Site Preparation	Afforestation Mechanical-(Bushhogging)	ac	20.00
490	Forest Site Preparation	Reforestation Mechanical-(Deep Tillage)	ac	146.00
512	Pasture and Hayland Planting	Seeding Introduced Species (seed, seedbed preparation, planting)	ac	61.25
528	Prescribed Grazing	Deferred Grazing	ac	50.00
533	Pumping Plant	Nose Pump for livestock water (pump, suction hose, foot valve, platform)	ea	572.00
561	Heavy Use Area Protection	Heavy Use Area - all surface material types (installed, mobilization, earthwork, all materials)	sf	3.00
575	Animal Trails and Walkways	Livestock Water Access Point - all surface material types (installed, mobilization, earthwork, all materials)	sf	3.00
578	Stream Crossing	Concrete low water crossing (installed, mobilization, crossing surface, earthwork)	lf	93.00
580	Streambank and Shoreline Protection	Shoreline Protection Vegetative Plantings (installed, mobilization, earthwork, plants)	lf	12.96

590	Nutrient Management	Precision Agriculture - with Yield Monitor	ac	36.00
601	Vegetative Barrier	Native species (seedbed prep, seed, planting)	lf	0.05
612	Tree/Shrub Establishment	Hardwood Bare Root Seedlings (Riparian Forest Buffer ONLY) (Planting included)	ac	135.00
614	Watering Facility	Permanent Water Trough 50 to 100 Gal (installed, materials)	ea	150.00
638	Water and Sediment Control Basin	Water and Sediment Control Basin (installed, mobilization, earthwork, outlet structure)	cy	2.40
655	Forest Harvest Trails & Landings	Broad Based Dip (installed, mobilization, earthwork)	ea	130.00
655	Forest Harvest Trails & Landings	Rolling Dip (installed, mobilization, earthwork)	ea	105.00
655	Forest Harvest Trails & Landings	Waterbar (installed, mobilization, earthwork)	ea	75.00
655	Forest Harvest Trails & Landings	Wing Ditch (installed, mobilization, earthwork)	ea	78.00
666	Forest Stand Improvement	Post Plant Weed Suppression Light Competition	ac	47.00
666	Forest Stand Improvement	Precommercial thinning	ac	140.00
717	Livestock Shade Structure	Livestock Portable Shade Structure	sf	4.60
ac=acre ea=each lf=linear feet sf= square feet cy=cubic yard				

8.0 TIMELINE FOR IMPLEMENTATION

LDEQ has implemented a watershed approach to ambient water quality monitoring. Beginning in 2004 LDEQ changed from a five-year rotating monitoring cycle to a four-year cycle. This change allows for the same level of water quality monitoring over a shorter period of time. At the same time, it allows regional field staffs responsible for the sampling to more evenly distribute their monitoring workload. The four-year cycle will also permit a more balanced schedule of water quality assessments for Integrated Reporting (305(b) and 303(d)) purposes.

Table 12. Implementation Timeline

Basin	First 4 Year Cycle	Second 4 Year Cycle
Mermentau	2004 -2007	2008-2011
Vermilion-Teche	2004 -2007	2008-2011
Calcasieu	2004,2005	2008, 2009
Ouachita	2004,2005	2008, 2009
Barataria	2004,2005	2008, 2009
Terrebonne	2004,2005	2008, 2009
Mississippi	2004,2005	2008, 2009
Pontchartrain	2006, 2007	2010, 2011
Pearl	2006	2010
Red	2004 -2007	2008-2011
Sabine	2006, 2007	2010, 2011
Atchafalaya	2004,2005	2008, 2009

Within each basin, all monitored sub-segments will be sampled over the year or years specified under each cycle period. Water quality assessments for the Integrated Report will be conducted for each basin following the last year of its monitoring period.

Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the water body. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been implemented by the time the first priority basins will be monitored again in the second four-year cycle. This will allow LDEQ to determine whether there has been any improvement in water quality following implementation of the TMDLs. As the monitoring results are evaluated at the end of each year, water bodies may be added to or removed from the 303(d) list.

8.1 Tracking and Evaluation

As stated in the Louisiana Nonpoint Management Plan, program tracking will be done at several levels to determine if the watershed approach is an effective method to reduce nonpoint source pollution and improve water quality:

1. Tracking of actions outlined with the Watershed Restoration Action Strategy (short-term)
2. Tracking of BMPs implemented as a result of Section 319, EQIP, or other sources of cost-share and technical assistance within the watershed (short term);
3. Tracking progress in reducing nonpoint source pollutants, such as solids, nutrients, and organic carbon from the various land uses (rice, soybeans, crawfish farms) within the watershed (short-term);
4. Tracking water quality improvement in the bayou (i.e. decreases in total

organic carbon, total dissolved oxygen) (short and long term)

5. Documenting results of the tracking to the Nonpoint Source Interagency Committee, residents within the watershed, and EPA (short and long term);
6. Submitting semi-annual and annual reports to EPA which summarize results of the watershed restoration actions (short and long term);
7. Revising LDEQ's web-site to include information on the progress made in watershed restoration actions, nonpoint source pollutant load reductions, and water quality improvement in the bayou (short and long term).

9.0 SUMMARY OF THE WATERSHED IMPLEMENTATION PLAN

In order to restore accepted water quality parameters in the Bayou Pierre Watershed, it will require a concerted effort from all of the stakeholders within it, including government (local, state, and federal), private and public groups and local citizens. A person who lives there and/or owns property in the watershed is a stakeholder and stands to benefit from their contribution toward protecting it. Public education is the first critical element for accomplishing goals and objectives, because it is necessary that they understand and support efforts to implement BMPs. Successful outcomes are more likely when citizens understand what is occurring and why.

The primary land uses in the watershed are forestland and agriculture land. Each type of land use that is identified within the watershed has BMPs that are known for reducing NPS pollutants loads and therefore increasing D.O. levels. Prevention of sediment runoff and runoff containing excess nutrients from land use activities occurring within the Bayou Pierre Watershed should result in D.O. water quality improvements in the bayou. Restoring natural flow through the bayou will also lead to improved D.O. levels in the bayou. Improved D.O. water quality will help to achieve and to sustain the bayou's designated uses, which in turn benefits other natural resources and future generations to come. However, the TMDL report for this bayou shows that a 100% reduction in man-made and 30% reduction in background loading is required in order to meet the dissolved oxygen criterion of 5 mg/L during the critical conditions that were applied for the model. LDEQ will continue to work on each of the water bodies in Louisiana to determine if the water quality standards are appropriately set and can be attained when the BMPs are in place.

Although some of the BMPs and the recommended course of actions were described within this plan, a consolidated list of BMPs recommended for each of these land uses can be viewed in the State of Louisiana Water Quality Management Plan, Volume 6, Louisiana's Nonpoint Source Management, 2000 located online at http://nonpoint.deq.louisiana.gov/wqa/NPSManagementPlan.htm.

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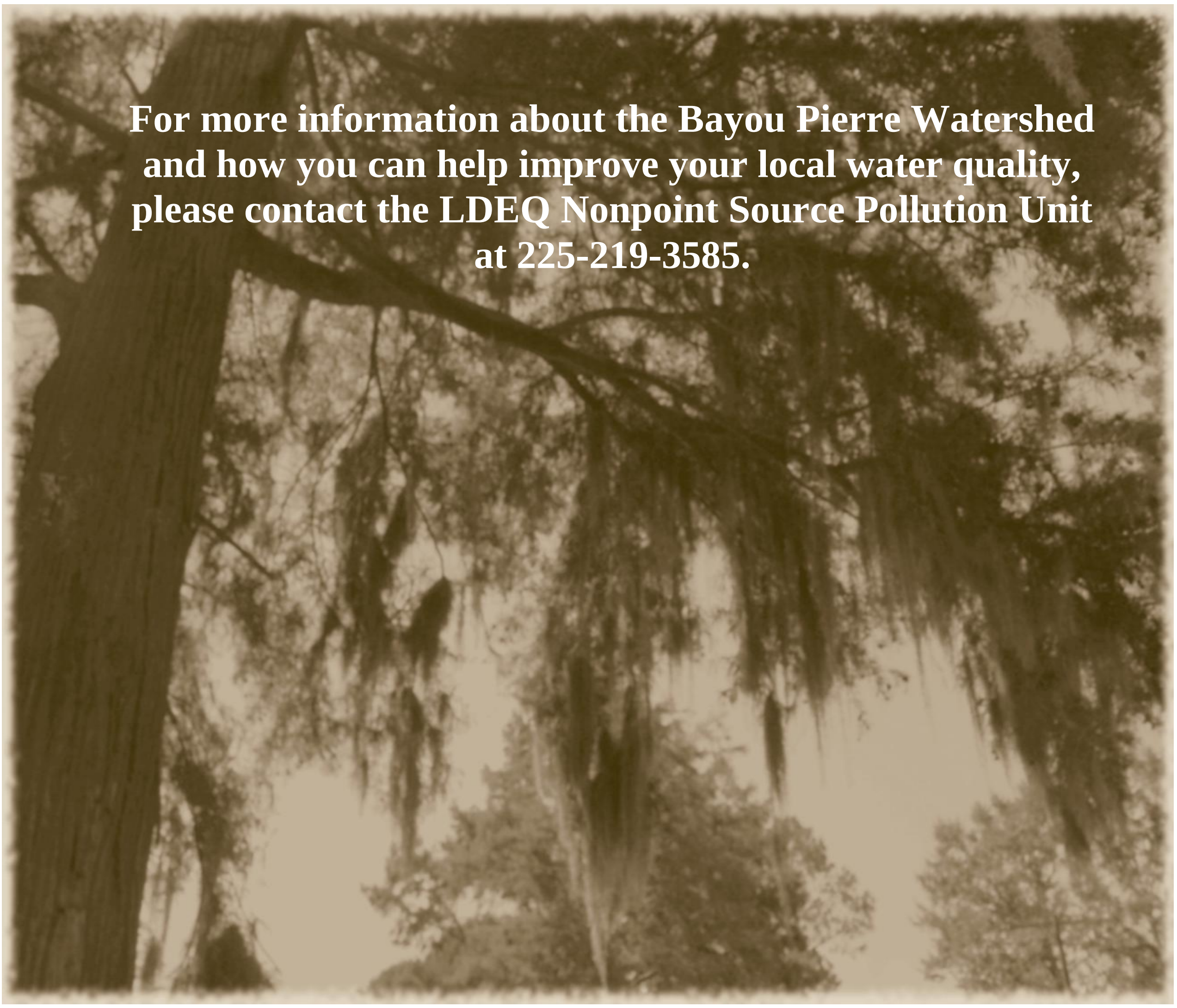
For more information about the Bayou Pierre Watershed
and how you can help improve your local water quality,
please contact the LDEQ Nonpoint Source Pollution Unit
at 225-219-3585.